

SEQUENCE LISTING

<110> The Scripps Research Institute
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Cropp, T Ashton
Chin, Jason W
Anderson, J Christopher
Schultz, Peter G

<120> UNNATURAL REACTIVE AMINO ACID GENETIC CODE ADDITIONS

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 gttccattgt tatgcctgaa acgcttccag caggcgggcc acaagccggt tgcgctggta 180
 ggcggcgca cgggtctgat tggcgacccg agcttcaaag ctgccgagcg taagctgaac 240
 accgaagaaa ctgttcagga gtgggtggac aaaatccgta agcaggttgc cccgttcctc 300
 gatttcgact gtggagaaaa ctctgctatc gcggccaata attatgactg gttcggcaat 360
 atgaatgtgc tgaccttctt gcgcgatatt ggcaaact tctccgttaa ccagatgac 420
 aacaaagaag cggttaagca gcgtctcaac cgtgaagatc aggggatttc gttcactgag 480
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<210> 15

<211> 540
 <212> DNA
 <213> artificial

<220>
 <223> artificial synthetase

<400> 15
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 gttccattgt tatgcctgaa acgcttccag caggcgggcc acaagccggt tgcgctggta 180
 ggcggcgca cgggtctgat tggcgacccg agcttcaaag ctgccgagcg taagctgaac 240
 accgaagaaa ctgttcagga gtgggtggac aaaatccgta agcaggttgc cccgttcctc 300
 gatttcgact gtggagaaaa ctctgctatc gcggccaata attatgactg gttcggcaat 360
 atgaatgtgc tgaccttctt gcgcgatatt ggcaaact tctccgttaa ccagatgac 420
 aacaaagaag cggttaagca gcgtctcaac cgtgaagatc aggggatttc gttcactgag 480
 ttttcctaca acctgctgca gggttatagt attgcctgtt tgaacaaaca gtacggtgtg 540

<210> 16
 <211> 540
 <212> DNA
 <213> artificial

<220>
 <223> artificial synthetase

<400> 16
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 gttccattgt tatgcctgaa acgcttccag caggcgggcc acaagccggt tgcgctggta 180
 ggcggcgca cgggtctgat tggcgacccg agcttcaagg ctgccgagcg taagctgaac 240
 accgaagaaa ctgttcagga gtgggtggac aaaatccgta agcaggttgc cccgttcctc 300
 gatttcgact gtggagaaaa ctctgctatc gcggccaatt gttatgactg gttcggcaat 360
 atgaatgtgc tgaccttctt gcgcgatatt ggcaaact tctccgttaa ccagatgac 420
 aacaaagaag cggttaagca gcgtctcaac cgtgaagatc aggggatttc gttcactgag 480
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<210> 17
 <211> 624
 <212> DNA
 <213> artificial

<220>
 <223> artificial synthetase

<400> 17
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ccgatcgac tcatttgtgg ctctgatcct accgctgaca gcttgcattt ggggcatctt 120
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ggcgggcgga cgggtctgat tggcgaccg agcttcaaag ctgccgagcg taagctgaac 240
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gtgctgcaaa ttggtggttc tgaccaatgg ggtaacatca cttctggtat cgacctgacc 600
cgctgtctgc atcagaatca ggtg 624

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<210> 18
 <211> 609
 <212> DNA
 <213> artificial

<220>
 <223> artificial synthetase

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<400> 18
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ctgaaadgct tccagcaggc gggccacaag ccggttgccg tggtaggcgg cgcgacgggt 180
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caggagtggg tggacaaaat ccgtaagcag gttgccccgt tcctcgattt cgactgtgga 300
gaaaactctg ctatcgcggc caataattat gactgggttc gcaatatgaa tgtgctgacc 360
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aagcagcgtc tcaaccgtga agatcagggg atttcgttca ctgagttttc ctacaacctg 480
ctgcaggggt atggttttgc ctgtttgaac aaacagtacg gtgtgggtgct gcaaattggt 540
ggttctgacc agtggggtaa catcacttct ggtatcgacc tgaccgctcg tctgcatcag 600
aatcaggtg 609

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<210> 19
 <211> 591
 <212> DNA
 <213> artificial

<220>
 <223> artificial synthetase

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<400> 19
gcgtagcag agcgactggc gcaaggcccg atcgactcg ggtgtggctt cgatcctacc 60

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gcggggccaca agccgggttgc gctggttaggc ggcgcgacgg gtctgattgg cgacccgagc      180
ttcaaagctg ccgagcgtaa gctgaacacc gaagaaactg ttcaggagtg ggtggacaaa      240
atccgtaagc aggttgcccc gttcctcgat ttcgactgtg gagaaaactc tgctatcgcg      300
gccataaatt atgactgggt cggcaatatg aatgtgctga ccttcctgcg cgatattggc      360
aaacacttct ccgttaacca gatgatcaac aaagaagcgg ttaagcagcg tctcaaccgt      420
gaagatcagg ggatttcggt cactgagttt tcctacaacc tgctgcaggg ttatggttat      480
gcctgtatga acaaacagta cgggtgtggtg ctgcaaattg gtggttctga ccagtggggg      540
aacatcactt ctggtatcga cctgaccctg cgtctgcacg agaatcaggt g              591

```

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<210> 20
<211> 621
<212> DNA
<213> artificial

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<220>
<223> artificial synthetase

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<220>
<221> misc_feature
<222> (26)..(26)
<223> n is a, c, g, or t

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<220>
<221> misc_feature
<222> (612)..(612)
<223> n is a, c, g, or t

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<220>
<221> misc_feature
<222> (618)..(618)
<223> n is a, c, g, or t

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<400> 20
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atcgcaactcc tttgtggctt cgatcctacc gctgacagct tgcatttggg gcatcttgtt      120
ccattgttat gcctgaaacg cttccagcag gcggggccaca agccgggttgc gctggttaggc      180
ggcgcgacgg gtctgattgg cgacccgagc ttcaaagctg ccgagcgtaa gctgaacacc      240
gaagaaactg ttcaggagtg ggtggacaaa atccgtaagc aggttgcccc gttcctcgat      300
ttcgactgtg gagaaaactc tgctatcgcg gccataaatt atgactgggt cggcaatatg      360
aatgtgctga ccttcctgcg cgatattggc aaacacttct ccgttaacca gatgatcaac      420
aaagaagcgg ttaagcagcg tctcaaccgt gaagatcagg ggatttcggt cactgagttt      480
tcctacaacc tgctgcaggg ttatttctat gcctgtgcga acaaacagta cgggtgtggtg      540
ctgcaaattg gtggttctga ccagtggggg aacatcactt ctggtatcga cctgaccctg      600
cgtctgcacg anaatcangt g              621

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<210> 21
 <211> 588
 <212> DNA
 <213> artificial

<220>
 <223> artificial synthetase

<400> 21
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 gacagcttgc atttggggca tcttgttcca ttgttatgcc tgaaacgctt ccagcaggcg 120
 ggccacaagc cggttgcgct ggtaggcggc gcgacgggtc tgattggcga cccgagcttc 180
 aaagctgccg agcgtaaagt gaacaccgaa gaaactgttc aggagtgggt ggacaaaatc 240
 cgtaagcagg ttgccccgtt cctcgatttc gactgtggag aaaactctgc tatcgcggcc 300
 aataattatg actggttcgg caatatgaat gtgctgacct tcctgcgcga tattggcaaa 360
 cacttctccg ttaaccagat gatcaacaaa gaagcgggta agcagcgtct caaccgtgaa 420
 gatcagggga tttcgttcac tgagttttcc tacaacctgc tgcaggggta ttctgcggcc 480
 tgtgcgaaca aacagtacgg tgtggtgctg caaattggtg gttctgacca gtggggtaac 540
 atcacttctg gtatcgacct gaccgctcgt ctgcatcaga atcaggtg 588

<210> 22
 <211> 600
 <212> DNA
 <213> artificial

<220>
 <223> artificial synthetase

<220>
 <221> misc_feature
 <222> (403)..(403)
 <223> n is a, c, g, or t

<220>
 <221> misc_feature
 <222> (513)..(513)
 <223> n is a, c, g, or t

<220>
 <221> misc_feature
 <222> (515)..(515)
 <223> n is a, c, g, or t

<220>
 <221> misc_feature
 <222> (518)..(518)
 <223> n is a, c, g, or t

<220>
 <221> misc_feature
 <222> (531)..(531)
 <223> n is a, c, g, or t

<400> 22
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gatcctaccg ctgacagctt gcatttgggg catcttggtc cattgttatg cctgaaacgc 120
ttccagcagg cggggccacaa gccgggttgcg ctggtaggcg gcgcgacggg tctgattggc 180
gacccgagct tcaaagctgc cgagcgtaag ctgaacaccg aagaaactgt tcaggagtgg 240
gtggacaaaa tccgtaagca ggttgccccg ttctctgatt tcgactgtgg agaaaactct 300
gctatcgcg ccaataatta tgactgggtc ggcaatatga atgtgctgac cttcctgcgc 360
gatattggca aacactttctc cgtaaccag atgatcaaca aanaagcggg taagcagcgt 420
ctcaaccgtg aagatcaggg gatttcgttc actgagtttt cctacaacct gctgcagggt 480
tattcggctg cctgtgcgaa caaacagtac gngngngngc tgcaaattgg nggttctgac 540
caggggggta acatcacttc tggatcgac ctgaccgcgc gtctgcatca aaatcagggtg 600

<210> 23
<211> 591
<212> DNA
<213> artificial

<220>
<223> artificial synthetase

<220>
<221> misc_feature
<222> (588)..(588)
<223> n is a, c, g, or t

<400> 23
gcgttagcag agcgactggc gcaaggcccg atcgactcg tttgtggctt cgatcctacc 60
gctgacagct tgcatttggg gcatcttggt ccattgttgt gcctgaaacg cttccagcag 120
gcggggccaca agccggttgc gctggtaggc ggcgcgacgg gtctgattgg cgacccgagc 180
ttcaaagctg ccgagcgtaa gctgaacacc gaagaaactg ttcaggagtg ggtggacaaa 240
atccgtaagc aggttgcccc gttcctcgat ttcgactgtg gagaaaactc tgctatcgcg 300
gccaataatt atgactgggt cggcaatatg aatgtgctga ccttcctgcg cgatattggc 360
aaacacttct ccgttaacca gatgatcaac aaagaagcgg ttaagcagcg tctcaaccgt 420
gaagatcagg ggatttcgtt cactgagttt tctacaacc tgctgcaggg ttatagtgcg 480
gcctgtgtta acaaacagta cgggtgtggt ctgcaaattg gtggttctga ccagtggggg 540
aacatcactt ctggtatcga cctgaccggt cgtctgcac agaatacngt g 591

<210> 24
<211> 600
<212> DNA
<213> artificial

<220>

<223> artificial synthetase

<400> 24

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gacgaggaag cgtagcaga gcgactggcg caaggcccga tcgcactcat ttgtggcttc      60
gatcctaccg ctgacagctt gcatttgggg catcttggtc cattgttatg cctgaaacgc      120
ttccagcagg cgggccacaa gccggttgcg ctggtaggcg gcgcgacggg tctgattggc      180
gacccgagct tcaaagctgc cgagcgtaag ctgaacaccg aagaaactgt tcaggagtgg      240
gtggacaaaa tccgtaagca gggtgccccg ttctctgatt tcgactgtgg agaaaactct      300
gctatcgcgg ccaatgatta tgactgggtc ggcaatatga atgtgctgac cttctcgcg      360
gatattggca aacacttctc cgtaaccag atgatcaaca aagaagcggg taagcagcgt      420
ctcaaccgtg aagatcaggg gatttcgttc actgagtttt cctacaacct gctgcagggg      480
tataattttg cctgtgtgaa caaacagtac ggtgtggtgc tgcaaattgg tggttctgac      540
cagtggggta acatcacttc tggatcgac ctgaccgctc gtctgcatca gaatcaggtg      600

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<210> 25

<211> 579

<212> DNA

<213> artificial

<220>

<223> artificial synthetase

<400> 25

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catttggggc atcttggtcc attggttatgc ctgaaacgct tccagcaggc gggccacaag      120
ccggttgcg      tggtaggcgg cgcgacgggt ctgattggcg acccgagctt caaagctgcc      180
gagcgtaagc tgaacaccga agaaactggt caggagtggg tggacaaaat ccgtaagcag      240
gttgccccgt tctctgattt cgactgtgga gaaaactctg ctatcgcggc caataattat      300
gactggttcg gcaatatgaa tgtgctgacc ttctcgcgcg atattggcaa acacttctcc      360
gttaaccaga tgatcaacaa agaagcgggt aagcagcgtc tcaaccgtga agatcagggg      420
atttcgttca ctgagttttc ctacaatctg ctgcaggggt attcggctgc ctgtcttaac      480
aaacagtacg gtgtgggtgct gcaaattggt gggtctgacc agtggggtaa catcacttct      540
ggtatcgacc tgaccgctcg tctgcatcag aatcaggtg      579

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<210> 26

<211> 624

<212> DNA

<213> artificial

<220>

<223> artificial synthetase

<220>

<221> misc_feature

<222> (13)..(13)
 <223> n is a, c, g, or t

<220>
 <221> misc_feature
 <222> (599)..(599)
 <223> n is a, c, g, or t

<400> 26
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 ccgatcgac tcgggtgtgg ctctgatcct accgctgaca gcttgcattt ggggcatctt 120
 gttccattgt tatgcctgaa acgcttccag caggcggggcc acaagccggt tgcgctggta 180
 ggcggcgcgga cgggtctgat tggcgacccg agcttcaaag ctgccgagcg taagctgaac 240
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 gatttcgact gtggagaaaa ctctgctatc gcggccaata attatgactg gttcggcaat 360
 atgaatgtgc tgaccttctt gcgcgatatt ggcaaact tctccgttaa ccagatgac 420
 aacaaagaag cggttaagca gcgtctcaac cgtgaagatc aggggatttc gttcactgag 480
 ttttctaca acctgctgca gggttattct atggcctgtt tgaacaaaca gtacgggtgtg 540
 gtgctgcaaa ttggtggttc tgaccagtgg ggtaacatca cttctggtat cgacctganc 600
 cgtcgtctgc atcagaatca ggtg 624

<210> 27
 <211> 625
 <212> DNA
 <213> artificial

<220>
 <223> artificial synthetase

<220>
 <221> misc_feature
 <222> (600)..(600)
 <223> n is a, c, g, or t

<400> 27
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 ccgatcgac tcacgtgtgg ctctgatcct accgctgaca gcttgcattt ggggcatctt 120
 gttccattgt tatgcctgaa acgcttccag caggcggggcc acaagccggt tgcgctggta 180
 ggcggcgcgga cgggtctgat tggcgacccg agcttcaaag ctgccgagcg taagctgaac 240
 accgaagaaa ctgttcagga gtgggtggac aaaatccgta agcaggttgc cccgttcctc 300
 gatttcgact gtggagaaaa ctctgctatc gcggccaata attatgactg gttcggcaat 360
 atgaatgtgc tgaccttctt gcgcgatatt ggcaaact tctccgttaa ccagatgac 420
 aacaaagaag cggttaagca gcgtctcaac cgtgaagatc aggggatttc gttcactgag 480
 ttttctaca atctgctgca gggttattcg gctgcctgtc ttaacaaaca gtacgggtgtg 540

gtgctgcaaa ttggtggttc tgaccagtgg ggtaacatca cttctggtat cgaacctgan 600
 ccgtcgtctg catcaaaatc aagtg 625

<210> 28
 <211> 624
 <212> DNA
 <213> artificial

<220>
 <223> artificial synthetase

<400> 28
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 ccgatcgac tctcttgtgg cttcgatcct accgctgaca gcttgcattt ggggcatctt 120
 gttccattgt tatgcctgaa acgcttccag caggcaggcc acaagccggt tgcgctggta 180
 ggcggcgcgga cgggtctgat tggcgacccg agcttcaaag ctgccgagcg taagctgaac 240
 accgaagaaa ctgttcagga gtgggtggac aaaatccgta agcagggttgcc cccgttcctc 300
 gatttcgact gtggagaaaa ctctgctatc gcggccaata attatgactg gttcggcaat 360
 atgaatgtgc tgaccttcct gcgcgatatt ggcaaact tctccgttaa ccagatgac 420
 aacaaagaag cggttaagca gcgtctcaac cgtgaagatc aggggatttc gttcactgag 480
 ttttcctaca acctgctgca gggttatacg atggcctgtg tgaacaaaca gtacgggtgtg 540
 gtgctgcaaa ttggtggttc tgaccagtgg ggtaacatca cttctggtat cgacctgacc 600
 cgctcgtctgc atcagaatca ggtg 624

<210> 29
 <211> 624
 <212> DNA
 <213> artificial

<220>
 <223> artificial synthetase

<400> 29
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 ccgatcgac tcgcgtgcgg cttcgatcct accgctgaca gcttgcattt ggggcatctt 120
 gttccattgt tatgcctgaa acgcttccag caggcgggccc acaagccggt tgcgctggta 180
 ggcggcgcgga cgggtctgat tggcgacccg agcttcaagg ctgccgagcg taagctgaac 240
 accgaagaaa ctgttcagga gtgggtggac aaaatccgta agcagggttgcc cccgttcctc 300
 gatttcgact gtggagaaaa ctctgctatc gcggccaata attatgactg gttcggcaat 360
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 aacaaagaag cggttaagca gcgtctcaac cgtgaagatc aggggatttc gttcactgag 480
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 gtgctgcaaa ttggtggttc tgaccagtgg ggtaacatca cttctggtat cgacctgacc 600

cgtcgtctgc atcagaatca ggtg

624

<210> 30

<211> 624

<212> DNA

<213> artificial

<220>

<223> artificial synthetase

<400> 30

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 ccgategcac tcgctgtgg cttcgatcct accgctgaca gcttgcattt ggggcatctt 120
 gttccattgt tatgcctgaa acgcttcag caggcgggcc acaagccggt tgcgctggta 180
 ggcggcgca cgggtctgat tggcgacccg agcttcaaag ctgccgagcg taagctgaac 240
 accgaagaaa ctgttcagga gtgggtggac aaaatccgta agcaggttgc cccgttcctc 300
 gatttcgact gtggagaaaa ctctgctatc gcggccaata attatgactg gttcggcaat 360
 atgaatgtgc tgaccttct ggcgatatt ggcaaact tctccgttaa ccagatgac 420
 aacaaagaag cggttaagca gcgtctcaac cgtgaagatc aggggatttc gttcactgag 480
 ttttcctaca acctgctgca gggttatacg atggcctgtt gtaacaaaca gtacgggtgtg 540
 gtgctgcaaa ttgggtggtc tgaccagtgg ggtaacatca cttctggtat cgacctgacc 600
 cgtcgtctgc atcagaatca ggtg 624

<210> 31

<211> 624

<212> DNA

<213> artificial

<220>

<223> artificial synthetase

<400> 31

cgggggctgg taccccaagt gacggacgag gaagcgtag cagagcgact ggcgcaaggc 60
 ccgategcac tcacgtgtgg cttcgatcct accgctgaca gcttgcattt ggggcatctt 120
 gttccattgt tatgcctgaa acgcttcag caggcgggcc acaagccggt tgcgctggta 180
 ggcggcgca cgggtctgat tggcgacccg agcttcaaag ctgccgagcg taagctgaac 240
 accgaagaaa ctgttcagga gtgggtggac aaaatccgta agcaggttgc cccgttcctc 300
 gatttcgact gtggagaaaa ctctgctatc gcggccaata attatgactg gttcggcaat 360
 atgaatgtgc tgaccttct ggcgatatt ggcaaact tctccgttaa ccagatgac 420
 aacaaagaag cggttaagca gcgtctcaac cgtgaagatc aggggatttc gttcgtgag 480
 ttttcctaca acctgctgca gggttatacg ttgcctgta tgaacaaaca gtacgggtgtg 540
 gtgctgcaaa ttgggtggtc tgaccagtgg ggtaacatca cttctggtat cgacctgacc 600

cgtcgtctgc atcagaatca ggtg

624

<210> 32

<211> 606

<212> DNA

<213> artificial

<220>

<223> artificial synthetase

<400> 32

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 ggcttcgata ctaccgctga cagcttgcac ttggggcatc ttgttccatt gttatgcctg 120
 aaacgcttcc agcagggcggg ccacaagccg gttgcgctgg taggcggcgc gacgggtctg 180
 attggcgacc cgagcttcaa agctgccgag cgtaagctga acaccgaaga aactgttcag 240
 gagtgggtgg aaaaaatccg taagcaggtt gccccgttcc tcgatttcga ctgtggagaa 300
 aactctgcta tcgcggccaa taattatgac tggttcggca atatgaatgt gctgaccttc 360
 ctgcgcgata ttggcaaaaca cttctccgtt aaccagatga tcaacaaaga agcgggttaag 420
 cagcgtctca accgtgaaga tcaggggatt tcgttctactg agttttccta caatctgctg 480
 caggggttatt cggctgcctg tcttaacaaa cagtacggtg tgggtgctgca aattgggtgg 540
 tctgaccagt ggggtaacat cacttctggt atcgacctga cccgtcgtct gcacagaat 600
 caggtg 606

<210> 33

<211> 624

<212> DNA

<213> artificial

<220>

<223> artificial synthetase

<400> 33

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 gttccattgt tatgcctgaa acgcttccag cagggcgggc acaagccggt tgcgctggta 180
 ggcggcgcga cgggtctgat tggcgacccg agcttcaaag ctgccgagcg taagctgaac 240
 accgaagaaa ctgttcagga gtgggtggac aaaatccgta agcaggttgc cccgttcctc 300
 gatttcgact gtggagaaaa ctctgctatc gcggccaata attatgactg gttcggcaat 360
 atgaatgtgc tgaccttctt gcgcgatatt ggcaaacact tctccgttaa ccagatgac 420
 aacaaagaag cgggttaagca gcgtctcaac cgtgaagatc aggggatttc gttcactgag 480
 ttttcctaca acctgctgca gggttattcg atggcctgta cgaacaaaca gtacggtgtg 540
 gtgctgcaaa ttgggtggtc tgaccagtgg ggtaacatca cttctggtat cgacctgacc 600
 cgtcgtctgc atcagaatca ggtg 624

<210> 34
 <211> 624
 <212> DNA
 <213> artificial

<220>
 <223> artificial synthetase

<220>
 <221> misc_feature
 <222> (13)..(13)
 <223> n is a, c, g, or t

<400> 34
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 ccgatcgac tcagttgtgg cttcgaccc accgctgaca gcttgcattt ggggcatctt 120
 gttccattgt tatgcctgaa acgcttccag caggcggggc acaagccggt tgcgctggta 180
 ggcggcgca cgggtctgat tggcgacccg agcttcaaag ctgccgagcg taagctgaac 240
 accgaagaaa ctgttcagga gtgggtggac aaaatccgta agcagggttc cccgttcctc 300
 gatctcgact gtggagaaaa ctctgctatc gcggccaata attatgactg gttcggcaat 360
 atgaatgtgc tgaccttctt gcgcgatatt ggcaaacact tctccgtaa ccagatgatc 420
 aacaaagaag cggttaagca gcgtctcaac cgtgaagatc aggggatttc gttcactgag 480
 ttttcctaca acctgctgca gggttatagt tttgcctgtc tgaacaaaca gtacgggtgtg 540
 gtgctgcaaa ttgggtgggtc tgaccagtgg ggtaacatca cttctggtat cgacctgacc 600
 cgtcgtctgc atcagaatca ggtg 624

<210> 35
 <211> 624
 <212> DNA
 <213> artificial

<220>
 <223> artificial synthetase

<400> 35
 cgggggctgg tagcccagggt gacggacgag gaagcgtag cagagcgact ggcgcaaggc 60
 ccgatcgac tcacgtgtgg cttcgaccc accgctgaca gcttgcattt ggggcatctt 120
 gttccattgt tatgcctgaa acgcttccag caggcggggc acaagccggt tgcgctggta 180
 ggcggcgca cgggtctgat tggcgacccg agcttcaaag ctgccgagcg taagctgaac 240
 accgaagaaa ctgttcagga gtgggtggac aaaatccgta agcagggttc cccgttcctc 300
 gatttcgact gtggagaaaa ctctgctatc gcggccaata attatgactg gttcggcaat 360
 atgaatgtgc tgaccttctt gcgcgatatt ggcaaacact tctccgtaa ccagatgatc 420
 aacaaagaag cggttaagca gcgtctcaac cgtgaagatc aggggatttc gttcactgag 480

ttttcctaca acctgctgca gggttatacg tttgcctgta ctaacaaaca gtacgggtgtg 540
 gtgctgcaaa ttgggtgggtc tgaccagtgg ggtaacatca cttctgggtat cgacctgacc 600
 cgtcgtctgc atcagaatca ggtg 624

<210> 36
 <211> 424
 <212> PRT
 <213> artificial

<220>
 <223> artificial synthetase

<400> 36

Met Ala Ser Ser Asn Leu Ile Lys Gln Leu Gln Glu Arg Gly Leu Val
 1 5 10 15

Ala Gln Val Thr Asp Glu Glu Ala Leu Ala Glu Arg Leu Ala Gln Gly
 20 25 30

Pro Ile Ala Leu Val Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His
 35 40 45

Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala
 50 55 60

Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly
 65 70 75 80

Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr
 85 90 95

Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu
 100 105 110

Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asn Tyr Asp
 115 120 125

Trp Phe Gly Asn Met Asn Val Leu Thr Phe Leu Arg Asp Ile Gly Lys
 130 135 140

His Phe Ser Val Asn Gln Met Ile Asn Lys Glu Ala Val Lys Gln Arg
 145 150 155 160

Leu Asn Arg Glu Asp Gln Gly Ile Ser Phe Thr Glu Phe Ser Tyr Asn
 165 170 175

Leu Leu Gln Gly Tyr Ser Tyr Ala Cys Leu Asn Lys Gln Tyr Gly Val
 180 185 190

Val Leu Gln Ile Gly Gly Ser Asp Gln Trp Gly Asn Ile Thr Ser Gly
 195 200 205
 Ile Asp Leu Thr Arg Arg Leu His Gln Asn Gln Val Phe Gly Leu Thr
 210 215 220
 Val Pro Leu Ile Thr Lys Ala Asp Gly Thr Lys Phe Gly Lys Thr Glu
 225 230 235 240
 Gly Gly Ala Val Trp Leu Asp Pro Lys Lys Thr Ser Pro Tyr Lys Phe
 245 250 255
 Tyr Gln Phe Trp Ile Asn Thr Ala Asp Ala Asp Val Tyr Arg Phe Leu
 260 265 270
 Lys Phe Phe Thr Phe Met Ser Ile Glu Glu Ile Asn Ala Leu Glu Glu
 275 280 285
 Glu Asp Lys Asn Ser Gly Lys Ala Pro Arg Ala Gln Tyr Val Leu Ala
 290 295 300
 Glu Gln Val Thr Arg Leu Val His Gly Glu Glu Gly Leu Gln Ala Ala
 305 310 315 320
 Lys Arg Ile Thr Glu Cys Leu Phe Ser Gly Ser Leu Ser Ala Leu Ser
 325 330 335
 Glu Ala Asp Phe Glu Gln Leu Ala Gln Asp Gly Val Pro Met Val Glu
 340 345 350
 Met Glu Lys Gly Ala Asp Leu Met Gln Ala Leu Val Asp Ser Glu Leu
 355 360 365
 Gln Pro Ser Arg Gly Gln Ala Arg Lys Thr Ile Ala Ser Asn Ala Ile
 370 375 380
 Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu
 385 390 395 400
 Glu Asp Arg Leu Phe Gly Arg Phe Thr Leu Leu Arg Arg Gly Lys Lys
 405 410 415
 Asn Tyr Cys Leu Ile Cys Trp Lys
 420

<210> 37
 <211> 424
 <212> PRT
 <213> artificial

<220>

<223> artificial synthetase

<400> 37

Met Ala Ser Ser Asn Leu Ile Lys Gln Leu Gln Glu Arg Gly Leu Val
 1 5 10 15

Ala Gln Val Thr Asp Glu Glu Ala Leu Ala Glu Arg Leu Ala Gln Gly
 20 25 30

Pro Ile Ala Leu Ile Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His
 35 40 45

Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala
 50 55 60

Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly
 65 70 75 80

Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr
 85 90 95

Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu
 100 105 110

Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asn Tyr Asp
 115 120 125

Trp Phe Gly Asn Met Asn Val Leu Thr Phe Leu Arg Asp Ile Gly Lys
 130 135 140

His Phe Ser Val Asn Gln Met Ile Asn Lys Glu Ala Val Lys Gln Arg
 145 150 155 160

Leu Asn Arg Glu Asp Gln Gly Ile Ser Phe Thr Glu Phe Ser Tyr Asn
 165 170 175

Leu Leu Gln Gly Tyr Ser Met Ala Cys Leu Asn Lys Gln Tyr Gly Val
 180 185 190

Val Leu Gln Ile Gly Gly Ser Asp Gln Trp Gly Asn Ile Thr Ser Gly
 195 200 205

Ile Asp Leu Thr Arg Arg Leu His Gln Asn Gln Val Phe Gly Leu Thr
 210 215 220

Val Pro Leu Ile Thr Lys Ala Asp Gly Thr Lys Phe Gly Lys Thr Glu
 225 230 235 240


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<210> 38
<211> 424
<212> PRT
<213> artificial
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<400> 38

Ala Gln Val Thr Asp Glu Glu Ala Leu Ala Glu Arg Leu Ala Gln Gly
20 25 30

Pro Ile Ala Leu Val Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His
 35 40 45
 Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala
 50 55 60
 Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly
 65 70 75 80
 Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr
 85 90 95
 Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu
 100 105 110
 Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asn Tyr Asp
 115 120 125
 Trp Phe Gly Asn Met Asn Val Leu Thr Phe Leu Arg Asp Ile Gly Lys
 130 135 140
 His Phe Ser Val Asn Gln Met Ile Asn Lys Glu Ala Val Lys Gln Arg
 145 150 155 160
 Leu Asn Arg Glu Asp Gln Gly Ile Ser Phe Thr Glu Phe Ser Tyr Asn
 165 170 175
 Leu Leu Gln Gly Tyr Ser Met Ala Cys Ala Asn Lys Gln Tyr Gly Val
 180 185 190
 Val Leu Gln Ile Gly Gly Ser Asp Gln Trp Gly Asn Ile Thr Ser Gly
 195 200 205
 Ile Asp Leu Thr Arg Arg Leu His Gln Asn Gln Val Phe Gly Leu Thr
 210 215 220
 Val Pro Leu Ile Thr Lys Ala Asp Gly Thr Lys Phe Gly Lys Thr Glu
 225 230 235 240
 Gly Gly Ala Val Trp Leu Asp Pro Lys Lys Thr Ser Pro Tyr Lys Phe
 245 250 255
 Tyr Gln Phe Trp Ile Asn Thr Ala Asp Ala Asp Val Tyr Arg Phe Leu
 260 265 270
 Lys Phe Phe Thr Phe Met Ser Ile Glu Glu Ile Asn Ala Leu Glu Glu
 275 280 285

Glu Asp Lys Asn Ser Gly Lys Ala Pro Arg Ala Gln Tyr Val Leu Ala
 290 295 300

Glu Gln Val Thr Arg Leu Val His Gly Glu Glu Gly Leu Gln Ala Ala
 305 310 315 320

Lys Arg Ile Thr Glu Cys Leu Phe Ser Gly Ser Leu Ser Ala Leu Ser
 325 330 335

Glu Ala Asp Phe Glu Gln Leu Ala Gln Asp Gly Val Pro Met Val Glu
 340 345 350

Met Glu Lys Gly Ala Asp Leu Met Gln Ala Leu Val Asp Ser Glu Leu
 355 360 365

Gln Pro Ser Arg Gly Gln Ala Arg Lys Thr Ile Ala Ser Asn Ala Ile
 370 375 380

Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu
 385 390 395 400

Glu Asp Arg Leu Phe Gly Arg Phe Thr Leu Leu Arg Arg Gly Lys Lys
 405 410 415

Asn Tyr Cys Leu Ile Cys Trp Lys
 420

<210> 39
 <211> 424
 <212> PRT
 <213> artificial

<220>
 <223> artificial synthetase

<400> 39

Met Ala Ser Ser Asn Leu Ile Lys Gln Leu Gln Glu Arg Gly Leu Val
 1 5 10 15

Ala Gln Val Thr Asp Glu Glu Ala Leu Ala Glu Arg Leu Ala Gln Gly
 20 25 30

Pro Ile Ala Leu Val Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His
 35 40 45

Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala
 50 55 60

Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly
 65 70 75 80

Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr
 85 90 95
 Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu
 100 105 110
 Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asn Tyr Asp
 115 120 125
 Trp Phe Gly Asn Met Asn Val Leu Thr Phe Leu Arg Asp Ile Gly Lys
 130 135 140
 His Phe Ser Val Asn Gln Met Ile Asn Lys Glu Ala Val Lys Gln Arg
 145 150 155 160
 Leu Asn Arg Glu Asp Gln Gly Ile Ser Phe Thr Glu Phe Ser Tyr Asn
 165 170 175
 Leu Leu Gln Gly Tyr Ser Met Ala Cys Leu Asn Lys Gln Tyr Gly Val
 180 185 190
 Val Leu Gln Ile Gly Gly Ser Asp Gln Trp Gly Asn Ile Thr Ser Gly
 195 200 205
 Ile Asp Leu Thr Arg Arg Leu His Gln Asn Gln Val Phe Gly Leu Thr
 210 215 220
 Val Pro Leu Ile Thr Lys Ala Asp Gly Thr Lys Phe Gly Lys Thr Glu
 225 230 235 240
 Gly Gly Ala Val Trp Leu Asp Pro Lys Lys Thr Ser Pro Tyr Lys Phe
 245 250 255
 Tyr Gln Phe Trp Ile Asn Thr Ala Asp Ala Asp Val Tyr Arg Phe Leu
 260 265 270
 Lys Phe Phe Thr Phe Met Ser Ile Glu Glu Ile Asn Ala Leu Glu Glu
 275 280 285
 Glu Asp Lys Asn Ser Gly Lys Ala Pro Arg Ala Gln Tyr Val Leu Ala
 290 295 300
 Glu Gln Val Thr Arg Leu Val His Gly Glu Glu Gly Leu Gln Ala Ala
 305 310 315 320
 Lys Arg Ile Thr Glu Cys Leu Phe Ser Gly Ser Leu Ser Ala Leu Ser
 325 330 335

Glu Ala Asp Phe Glu Gln Leu Ala Gln Asp Gly Val Pro Met Val Glu
 340 345 350

Met Glu Lys Gly Ala Asp Leu Met Gln Ala Leu Val Asp Ser Glu Leu
 355 360 365

Gln Pro Ser Arg Gly Gln Ala Arg Lys Thr Ile Ala Ser Asn Ala Ile
 370 375 380

Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu
 385 390 395 400

Glu Asp Arg Leu Phe Gly Arg Phe Thr Leu Leu Arg Arg Gly Lys Lys
 405 410 415

Asn Tyr Cys Leu Ile Cys Trp Lys
 420

<210> 40
 <211> 424
 <212> PRT
 <213> artificial

<220>
 <223> artificial synthetase

<400> 40

Met Ala Ser Ser Asn Leu Ile Lys Gln Leu Gln Glu Arg Gly Leu Val
 1 5 10 15

Ala Gln Val Thr Asp Glu Glu Ala Leu Ala Glu Arg Leu Ala Gln Gly
 20 25 30

Pro Ile Ala Leu Thr Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His
 35 40 45

Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala
 50 55 60

Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly
 65 70 75 80

Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr
 85 90 95

Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu
 100 105 110

Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asn Tyr Asp
 115 120 125

Trp Phe Gly Asn Met Asn Val Leu Thr Phe Leu Arg Asp Ile Gly Lys
 130 135 140
 His Phe Ser Val Asn Gln Met Ile Asn Lys Glu Ala Val Lys Gln Arg
 145 150 155 160
 Leu Asn Arg Glu Asp Gln Gly Ile Ser Phe Thr Glu Phe Ser Tyr Asn
 165 170 175
 Leu Leu Gln Gly Tyr Thr Met Ala Cys Leu Asn Lys Gln Tyr Gly Val
 180 185 190
 Val Leu Gln Ile Gly Gly Ser Asp Gln Trp Gly Asn Ile Thr Ser Gly
 195 200 205
 Ile Asp Leu Thr Arg Arg Leu His Gln Asn Gln Val Phe Gly Leu Thr
 210 215 220
 Val Pro Leu Ile Thr Lys Ala Asp Gly Thr Lys Phe Gly Lys Thr Glu
 225 230 235 240
 Gly Gly Ala Val Trp Leu Asp Pro Lys Lys Thr Ser Pro Tyr Lys Phe
 245 250 255
 Tyr Gln Phe Trp Ile Asn Thr Ala Asp Ala Asp Val Tyr Arg Phe Leu
 260 265 270
 Lys Phe Phe Thr Phe Met Ser Ile Glu Glu Ile Asn Ala Leu Glu Glu
 275 280 285
 Glu Asp Lys Asn Ser Gly Lys Ala Pro Arg Ala Gln Tyr Val Leu Ala
 290 295 300
 Glu Gln Val Thr Arg Leu Val His Gly Glu Glu Gly Leu Gln Ala Ala
 305 310 315 320
 Lys Arg Ile Thr Glu Cys Leu Phe Ser Gly Ser Leu Ser Ala Leu Ser
 325 330 335
 Glu Ala Asp Phe Glu Gln Leu Ala Gln Asp Gly Val Pro Met Val Glu
 340 345 350
 Met Glu Lys Gly Ala Asp Leu Met Gln Ala Leu Val Asp Ser Glu Leu
 355 360 365
 Gln Pro Ser Arg Gly Gln Ala Arg Lys Thr Ile Ala Ser Asn Ala Ile
 370 375 380

Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu
 385 390 395 400

Glu Asp Arg Leu Phe Gly Arg Phe Thr Leu Leu Arg Arg Gly Lys Lys
 405 410 415

Asn Tyr Cys Leu Ile Cys Trp Lys
 420

<210> 41
 <211> 424
 <212> PRT
 <213> artificial

<220>
 <223> artificial synthetase

<400> 41

Met Ala Ser Ser Asn Leu Ile Lys Gln Leu Gln Glu Arg Gly Leu Val
 1 5 10 15

Ala Gln Val Thr Asp Glu Glu Ala Leu Ala Glu Arg Leu Ala Gln Gly
 20 25 30

Pro Ile Ala Leu Thr Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His
 35 40 45

Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala
 50 55 60

Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly
 65 70 75 80

Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr
 85 90 95

Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu
 100 105 110

Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asn Tyr Asp
 115 120 125

Trp Phe Gly Asn Met Asn Val Leu Thr Phe Leu Arg Asp Ile Gly Lys
 130 135 140

His Phe Ser Val Asn Gln Met Ile Asn Lys Glu Ala Val Lys Gln Arg
 145 150 155 160

Leu Asn Arg Glu Asp Gln Gly Ile Ser Phe Thr Glu Phe Ser Tyr Asn
 165 170 175

Leu Leu Gln Gly Tyr Thr Tyr Ala Cys Leu Asn Lys Gln Tyr Gly Val
 180 185 190
 Val Leu Gln Ile Gly Gly Ser Asp Gln Trp Gly Asn Ile Thr Ser Gly
 195 200 205
 Ile Asp Leu Thr Arg Arg Leu His Gln Asn Gln Val Phe Gly Leu Thr
 210 215 220
 Val Pro Leu Ile Thr Lys Ala Asp Gly Thr Lys Phe Gly Lys Thr Glu
 225 230 235 240
 Gly Gly Ala Val Trp Leu Asp Pro Lys Lys Thr Ser Pro Tyr Lys Phe
 245 250 255
 Tyr Gln Phe Trp Ile Asn Thr Ala Asp Ala Asp Val Tyr Arg Phe Leu
 260 265 270
 Lys Phe Phe Thr Phe Met Ser Ile Glu Glu Ile Asn Ala Leu Glu Glu
 275 280 285
 Glu Asp Lys Asn Ser Gly Lys Ala Pro Arg Ala Gln Tyr Val Leu Ala
 290 295 300
 Glu Gln Val Thr Arg Leu Val His Gly Glu Glu Gly Leu Gln Ala Ala
 305 310 315 320
 Lys Arg Ile Thr Glu Cys Leu Phe Ser Gly Ser Leu Ser Ala Leu Ser
 325 330 335
 Glu Ala Asp Phe Glu Gln Leu Ala Gln Asp Gly Val Pro Met Val Glu
 340 345 350
 Met Glu Lys Gly Ala Asp Leu Met Gln Ala Leu Val Asp Ser Glu Leu
 355 360 365
 Gln Pro Ser Arg Gly Gln Ala Arg Lys Thr Ile Ala Ser Asn Ala Ile
 370 375 380
 Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu
 385 390 395 400
 Glu Asp Arg Leu Phe Gly Arg Phe Thr Leu Leu Arg Arg Gly Lys Lys
 405 410 415
 Asn Tyr Cys Leu Ile Cys Trp Lys
 420

<210> 42
 <211> 424
 <212> PRT
 <213> artificial

<220>
 <223> artificial synthetase

<400> 42

Met Ala Ser Ser Asn Leu Ile Lys Gln Leu Gln Glu Arg Gly Leu Val
 1 5 10 15

Ala Gln Val Thr Asp Glu Glu Ala Leu Ala Glu Arg Leu Ala Gln Gly
 20 25 30

Pro Ile Ala Leu Leu Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His
 35 40 45

Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala
 50 55 60

Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly
 65 70 75 80

Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr
 85 90 95

Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu
 100 105 110

Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asn Tyr Asp
 115 120 125

Trp Phe Gly Asn Met Asn Val Leu Thr Phe Leu Arg Asp Ile Gly Lys
 130 135 140

His Phe Ser Val Asn Gln Met Ile Asn Lys Glu Ala Val Lys Gln Arg
 145 150 155 160

Leu Asn Arg Glu Asp Gln Gly Ile Ser Phe Thr Glu Phe Ser Tyr Asn
 165 170 175

Leu Leu Gln Gly Tyr Ser Met Ala Cys Ser Asn Lys Gln Tyr Gly Val
 180 185 190

Val Leu Gln Ile Gly Gly Ser Asp Gln Trp Gly Asn Ile Thr Ser Gly
 195 200 205

Ile Asp Leu Thr Arg Arg Leu His Gln Asn Gln Val Phe Gly Leu Thr
 210 215 220

Val Pro Leu Ile Thr Lys Ala Asp Gly Thr Lys Phe Gly Lys Thr Glu
 225 230 235 240
 Gly Gly Ala Val Trp Leu Asp Pro Lys Lys Thr Ser Pro Tyr Lys Phe
 245 250 255
 Tyr Gln Phe Trp Ile Asn Thr Ala Asp Ala Asp Val Tyr Arg Phe Leu
 260 265 270
 Lys Phe Phe Thr Phe Met Ser Ile Glu Glu Ile Asn Ala Leu Glu Glu
 275 280 285
 Glu Asp Lys Asn Ser Gly Lys Ala Pro Arg Ala Gln Tyr Val Leu Ala
 290 295 300
 Glu Gln Val Thr Arg Leu Val His Gly Glu Glu Gly Leu Gln Ala Ala
 305 310 315 320
 Lys Arg Ile Thr Glu Cys Leu Phe Ser Gly Ser Leu Ser Ala Leu Ser
 325 330 335
 Glu Ala Asp Phe Glu Gln Leu Ala Gln Asp Gly Val Pro Met Val Glu
 340 345 350
 Met Glu Lys Gly Ala Asp Leu Met Gln Ala Leu Val Asp Ser Glu Leu
 355 360 365
 Gln Pro Ser Arg Gly Gln Ala Arg Lys Thr Ile Ala Ser Asn Ala Ile
 370 375 380
 Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu
 385 390 395 400
 Glu Asp Arg Leu Phe Gly Arg Phe Thr Leu Leu Arg Arg Gly Lys Lys
 405 410 415
 Asn Tyr Cys Leu Ile Cys Trp Lys
 420
 <210> 43
 <211> 424
 <212> PRT
 <213> artificial
 <220>
 <223> artificial synthetase
 <400> 43
 Met Ala Ser Ser Asn Leu Ile Lys Gln Leu Gln Glu Arg Gly Leu Val
 1 5 10 15

Ala Gln Val Thr Asp Glu Glu Ala Leu Ala Glu Arg Leu Ala Gln Gly
 20 25 30

Pro Ile Ala Leu Leu Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His
 35 40 45

Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala
 50 55 60

Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly
 65 70 75 80

Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr
 85 90 95

Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu
 100 105 110

Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asn Tyr Asp
 115 120 125

Trp Phe Gly Asn Met Asn Val Leu Thr Phe Leu Arg Asp Ile Gly Lys
 130 135 140

His Phe Ser Val Asn Gln Met Ile Asn Lys Glu Ala Val Lys Gln Arg
 145 150 155 160

Leu Asn Arg Glu Asp Gln Gly Ile Ser Phe Thr Glu Phe Ser Tyr Asn
 165 170 175

Leu Leu Gln Gly Tyr Ser Met Ala Cys Ala Asn Lys Gln Tyr Gly Val
 180 185 190

Val Leu Gln Ile Gly Gly Ser Asp Gln Trp Gly Asn Ile Thr Ser Gly
 195 200 205

Ile Asp Leu Thr Arg Arg Leu His Gln Asn Gln Val Phe Gly Leu Thr
 210 215 220

Val Pro Leu Ile Thr Lys Ala Asp Gly Thr Lys Phe Gly Lys Thr Glu
 225 230 235 240

Gly Gly Ala Val Trp Leu Asp Pro Lys Lys Thr Ser Pro Tyr Lys Phe
 245 250 255

Tyr Gln Phe Trp Ile Asn Thr Ala Asp Ala Asp Val Tyr Arg Phe Leu
 260 265 270

Lys Phe Phe Thr Phe Met Ser Ile Glu Glu Ile Asn Ala Leu Glu Glu
 275 280 285
 Glu Asp Lys Asn Ser Gly Lys Ala Pro Arg Ala Gln Tyr Val Leu Ala
 290 295 300
 Glu Gln Val Thr Arg Leu Val His Gly Glu Glu Gly Leu Gln Ala Ala
 305 310 315 320
 Lys Arg Ile Thr Glu Cys Leu Phe Ser Gly Ser Leu Ser Ala Leu Ser
 325 330 335
 Glu Ala Asp Phe Glu Gln Leu Ala Gln Asp Gly Val Pro Met Val Glu
 340 345 350
 Met Glu Lys Gly Ala Asp Leu Met Gln Ala Leu Val Asp Ser Glu Leu
 355 360 365
 Gln Pro Ser Arg Gly Gln Ala Arg Lys Thr Ile Ala Ser Asn Ala Ile
 370 375 380
 Thr Ile Asn Gly, Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu
 385 390 395 400
 Glu Asp Arg Leu Phe Gly Arg Phe Thr Leu Leu Arg Arg Gly Lys Lys
 405 410 415
 Asn Tyr Cys Leu Ile Cys Trp Lys
 420
 <210> 44
 <211> 424
 <212> PRT
 <213> artificial
 <220>
 <223> artificial synthetase
 <400> 44
 Met Ala Ser Ser Asn Leu Ile Lys Gln Leu Gln Glu Arg Gly Leu Val
 1 5 10 15
 Ala Gln Val Thr Asp Glu Glu Ala Leu Ala Glu Arg Leu Ala Gln Gly
 20 25 30
 Pro Ile Ala Leu Thr Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His
 35 40 45
 Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala
 50 55 60

Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly
 65 70 75 80
 Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr
 85 90 95
 Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu
 100 105 110
 Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asn Tyr Asp
 115 120 125
 Trp Phe Gly Asn Met Asn Val Leu Thr Phe Leu Arg Asp Ile Gly Lys
 130 135 140
 His Phe Ser Val Asn Gln Met Ile Asn Lys Glu Ala Val Lys Gln Arg
 145 150 155 160
 Leu Asn Arg Glu Asp Gln Gly Ile Ser Phe Thr Glu Phe Ser Tyr Asn
 165 170 175
 Leu Leu Gln Gly Tyr Arg Met Ala Cys Leu Asn Lys Gln Tyr Gly Val
 180 185 190
 Val Leu Gln Ile Gly Gly Ser Asp Gln Trp Gly Asn Ile Thr Ser Gly
 195 200 205
 Ile Asp Leu Thr Arg Arg Leu His Gln Asn Gln Val Phe Gly Leu Thr
 210 215 220
 Val Pro Leu Ile Thr Lys Ala Asp Gly Thr Lys Phe Gly Lys Thr Glu
 225 230 235 240
 Gly Gly Ala Val Trp Leu Asp Pro Lys Lys Thr Ser Pro Tyr Lys Phe
 245 250 255
 Tyr Gln Phe Trp Ile Asn Thr Ala Asp Ala Asp Val Tyr Arg Phe Leu
 260 265 270
 Lys Phe Phe Thr Phe Met Ser Ile Glu Glu Ile Asn Ala Leu Glu Glu
 275 280 285
 Glu Asp Lys Asn Ser Gly Lys Ala Pro Arg Ala Gln Tyr Val Leu Ala
 290 295 300
 Glu Gln Val Thr Arg Leu Val His Gly Glu Glu Gly Leu Gln Ala Ala
 305 310 315 320

Lys Arg Ile Thr Glu Cys Leu Phe Ser Gly Ser Leu Ser Ala Leu Ser
 325 330 335

Glu Ala Asp Phe Glu Gln Leu Ala Gln Asp Gly Val Pro Met Val Glu
 340 345 350

Met Glu Lys Gly Ala Asp Leu Met Gln Ala Leu Val Asp Ser Glu Leu
 355 360 365

Gln Pro Ser Arg Gly Gln Ala Arg Lys Thr Ile Ala Ser Asn Ala Ile
 370 375 380

Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu
 385 390 395 400

Glu Asp Arg Leu Phe Gly Arg Phe Thr Leu Leu Arg Arg Gly Lys Lys
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Asn Tyr Cys Leu Ile Cys Trp Lys
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Pro Ile Ala Leu Ile Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His
 35 40 45

Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala
 50 55 60

Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly
 65 70 75 80

Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr
 85 90 95

Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu
 100 105 110

Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asn Tyr Asp
 115 120 125
 Trp Phe Gly Asn Met Asn Val Leu Thr Phe Leu Arg Asp Ile Gly Lys
 130 135 140
 His Phe Ser Val Asn Gln Met Ile Asn Lys Glu Ala Val Lys Gln Arg
 145 150 155 160
 Leu Asn Arg Glu Asp Gln Gly Ile Ser Phe Thr Glu Phe Ser Tyr Asn
 165 170 175
 Leu Leu Gln Gly Tyr Gly Met Ala Cys Ala Asn Lys Gln Tyr Gly Val
 180 185 190
 Val Leu Gln Ile Gly Gly Ser Asp Gln Trp Gly Asn Ile Thr Ser Gly
 195 200 205
 Ile Asp Leu Thr Arg Arg Leu His Gln Asn Gln Val Phe Gly Leu Thr
 210 215 220
 Val Pro Leu Ile Thr Lys Ala Asp Gly Thr Lys Phe Gly Lys Thr Glu
 225 230 235 240
 Gly Gly Ala Val Trp Leu Asp Pro Lys Lys Thr Ser Pro Tyr Lys Phe
 245 250 255
 Tyr Gln Phe Trp Ile Asn Thr Ala Asp Ala Asp Val Tyr Arg Phe Leu
 260 265 270
 Lys Phe Phe Thr Phe Met Ser Ile Glu Glu Ile Asn Ala Leu Glu Glu
 275 280 285
 Glu Asp Lys Asn Ser Gly Lys Ala Pro Arg Ala Gln Tyr Val Leu Ala
 290 295 300
 Glu Gln Val Thr Arg Leu Val His Gly Glu Glu Gly Leu Gln Ala Ala
 305 310 315 320
 Lys Arg Ile Thr Glu Cys Leu Phe Ser Gly Ser Leu Ser Ala Leu Ser
 325 330 335
 Glu Ala Asp Phe Glu Gln Leu Ala Gln Asp Gly Val Pro Met Val Glu
 340 345 350
 Met Glu Lys Gly Ala Asp Leu Met Gln Ala Leu Val Asp Ser Glu Leu
 355 360 365

Gln Pro Ser Arg Gly Gln Ala Arg Lys Thr Ile Ala Ser Asn Ala Ile
 370 375 380

Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu
 385 390 395 400

Glu Asp Arg Leu Phe Gly Arg Phe Thr Leu Leu Arg Arg Gly Lys Lys
 405 410 415

Asn Tyr Cys Leu Ile Cys Trp Lys
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Pro Ile Ala Leu Gly Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His
 35 40 45

Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala
 50 55 60

Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly
 65 70 75 80

Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr
 85 90 95

Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu
 100 105 110

Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asn Tyr Asp
 115 120 125

Trp Phe Gly Asn Met Asn Val Leu Thr Phe Leu Arg Asp Ile Gly Lys
 130 135 140

His Phe Ser Val Asn Gln Met Ile Asn Lys Glu Ala Val Lys Gln Arg
 145 150 155 160

Leu Asn Arg Glu Asp Gln Gly Ile Ser Phe Thr Glu Phe Ser Tyr Asn
 165 170 175
 Leu Leu Gln Gly Tyr Gly Phe Ala Cys Ala Asn Lys Gln Tyr Gly Val
 180 185 190
 Val Leu Gln Ile Gly Gly Ser Asp Gln Trp Gly Asn Ile Thr Ser Gly
 195 200 205
 Ile Asp Leu Thr Arg Arg Leu His Gln Asn Gln Val Phe Gly Leu Thr
 210 215 220
 Val Pro Leu Ile Thr Lys Ala Asp Gly Thr Lys Phe Gly Lys Thr Glu
 225 230 235 240
 Gly Gly Ala Val Trp Leu Asp Pro Lys Lys Thr Ser Pro Tyr Lys Phe
 245 250 255
 Tyr Gln Phe Trp Ile Asn Thr Ala Asp Ala Asp Val Tyr Arg Phe Leu
 260 265 270
 Lys Phe Phe Thr Phe Met Ser Ile Glu Glu Ile Asn Ala Leu Glu Glu
 275 280 285
 Glu Asp Lys Asn Ser Gly Lys Ala Pro Arg Ala Gln Tyr Val Leu Ala
 290 295 300
 Glu Gln Val Thr Arg Leu Val His Gly Glu Glu Gly Leu Gln Ala Ala
 305 310 315 320
 Lys Arg Ile Thr Glu Cys Leu Phe Ser Gly Ser Leu Ser Ala Leu Ser
 325 330 335
 Glu Ala Asp Phe Glu Gln Leu Ala Gln Asp Gly Val Pro Met Val Glu
 340 345 350
 Met Glu Lys Gly Ala Asp Leu Met Gln Ala Leu Val Asp Ser Glu Leu
 355 360 365
 Gln Pro Ser Arg Gly Gln Ala Arg Lys Thr Ile Ala Ser Asn Ala Ile
 370 375 380
 Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu
 385 390 395 400
 Glu Asp Arg Leu Phe Gly Arg Phe Thr Leu Leu Arg Arg Gly Lys Lys
 405 410 415

Asn Tyr Cys Leu Ile Cys Trp Lys
420

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Pro Ile Ala Leu Gly Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His
35 40 45

Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala
50 55 60

Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly
65 70 75 80

Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr
85 90 95

Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu
100 105 110

Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asn Tyr Asp
115 120 125

Trp Phe Gly Asn Met Asn Val Leu Thr Phe Leu Arg Asp Ile Gly Lys
130 135 140

His Phe Ser Val Asn Gln Met Ile Asn Lys Glu Ala Val Lys Gln Arg
145 150 155 160

Leu Asn Arg Glu Asp Gln Gly Ile Ser Phe Thr Glu Phe Ser Tyr Asn
165 170 175

Leu Leu Gln Gly Tyr Gly Tyr Ala Cys Met Asn Lys Gln Tyr Gly Val
180 185 190

Val Leu Gln Ile Gly Gly Ser Asp Gln Trp Gly Asn Ile Thr Ser Gly
195 200 205

Ile Asp Leu Thr Arg Arg Leu His Gln Asn Gln Val Phe Gly Leu Thr
 210 215 220
 Val Pro Leu Ile Thr Lys Ala Asp Gly Thr Lys Phe Gly Lys Thr Glu
 225 230 235 240
 Gly Gly Ala Val Trp Leu Asp Pro Lys Lys Thr Ser Pro Tyr Lys Phe
 245 250 255
 Tyr Gln Phe Trp Ile Asn Thr Ala Asp Ala Asp Val Tyr Arg Phe Leu
 260 265 270
 Lys Phe Phe Thr Phe Met Ser Ile Glu Glu Ile Asn Ala Leu Glu Glu
 275 280 285
 Glu Asp Lys Asn Ser Gly Lys Ala Pro Arg Ala Gln Tyr Val Leu Ala
 290 295 300
 Glu Gln Val Thr Arg Leu Val His Gly Glu Glu Gly Leu Gln Ala Ala
 305 310 315 320
 Lys Arg Ile Thr Glu Cys Leu Phe Ser Gly Ser Leu Ser Ala Leu Ser
 325 330 335
 Glu Ala Asp Phe Glu Gln Leu Ala Gln Asp Gly Val Pro Met Val Glu
 340 345 350
 Met Glu Lys Gly Ala Asp Leu Met Gln Ala Leu Val Asp Ser Glu Leu
 355 360 365
 Gln Pro Ser Arg Gly Gln Ala Arg Lys Thr Ile Ala Ser Asn Ala Ile
 370 375 380
 Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu
 385 390 395 400
 Glu Asp Arg Leu Phe Gly Arg Phe Thr Leu Leu Arg Arg Gly Lys Lys
 405 410 415
 Asn Tyr Cys Leu Ile Cys Trp Lys
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 Pro Ile Ala Leu Leu Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His
 35 40 45
 Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala
 50 55 60
 Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly
 65 70 75 80
 Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr
 85 90 95
 Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu
 100 105 110
 Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asn Tyr Asp
 115 120 125
 Trp Phe Gly Asn Met Asn Val Leu Thr Phe Leu Arg Asp Ile Gly Lys
 130 135 140
 His Phe Ser Val Asn Gln Met Ile Asn Lys Glu Ala Val Lys Gln Arg
 145 150 155 160
 Leu Asn Arg Glu Asp Gln Gly Ile Ser Phe Thr Glu Phe Ser Tyr Asn
 165 170 175
 Leu Leu Gln Gly Tyr Ser Met Ala Cys Ala Asn Lys Gln Tyr Gly Val
 180 185 190
 Val Leu Gln Ile Gly Gly Ser Asp Gln Trp Gly Asn Ile Thr Ser Gly
 195 200 205
 Ile Asp Leu Thr Arg Arg Leu His Gln Asn Gln Val Phe Gly Leu Thr
 210 215 220
 Val Pro Leu Ile Thr Lys Ala Asp Gly Thr Lys Phe Gly Lys Thr Glu
 225 230 235 240
 Gly Gly Ala Val Trp Leu Asp Pro Lys Lys Thr Ser Pro Tyr Lys Phe
 245 250 255

Tyr Gln Phe Trp Ile Asn Thr Ala Asp Ala Asp Val Tyr Arg Phe Leu
 260 265 270

Lys Phe Phe Thr Phe Met Ser Ile Glu Glu Ile Asn Ala Leu Glu Glu
 275 280 285

Glu Asp Lys Asn Ser Gly Lys Ala Pro Arg Ala Gln Tyr Val Leu Ala
 290 295 300

Glu Gln Val Thr Arg Leu Val His Gly Glu Glu Gly Leu Gln Ala Ala
 305 310 315 320

Lys Arg Ile Thr Glu Cys Leu Phe Ser Gly Ser Leu Ser Ala Leu Ser
 325 330 335

Glu Ala Asp Phe Glu Gln Leu Ala Gln Asp Gly Val Pro Met Val Glu
 340 345 350

Met Glu Lys Gly Ala Asp Leu Met Gln Ala Leu Val Asp Ser Glu Leu
 355 360 365

Gln Pro Ser Arg Gly Gln Ala Arg Lys Thr Ile Ala Ser Asn Ala Ile
 370 375 380

Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu
 385 390 395 400

Glu Asp Arg Leu Phe Gly Arg Phe Thr Leu Leu Arg Arg Gly Lys Lys
 405 410 415

Asn Tyr Cys Leu Ile Cys Trp Lys
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Ala Gln Val Thr Asp Glu Glu Ala Leu Ala Glu Arg Leu Ala Gln Gly
 20 25 30

Pro Ile Ala Leu Val Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His
 Page 45

35

40

45

Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala
 50 55 60

Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly
 65 70 75 80

Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr
 85 90 95

Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu
 100 105 110

Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asn Tyr Asp
 115 120 125

Trp Phe Gly Asn Met Asn Val Leu Thr Phe Leu Arg Asp Ile Gly Lys
 130 135 140

His Phe Ser Val Asn Gln Met Ile Asn Lys Glu Ala Val Lys Gln Arg
 145 150 155 160

Leu Asn Arg Glu Asp Gln Gly Ile Ser Phe Thr Glu Phe Ser Tyr Asn
 165 170 175

Leu Leu Gln Gly Tyr Ser Ala Ala Cys Ala Asn Lys Gln Tyr Gly Val
 180 185 190

Val Leu Gln Ile Gly Gly Ser Asp Gln Trp Gly Asn Ile Thr Ser Gly
 195 200 205

Ile Asp Leu Thr Arg Arg Leu His Gln Asn Gln Val Phe Gly Leu Thr
 210 215 220

Val Pro Leu Ile Thr Lys Ala Asp Gly Thr Lys Phe Gly Lys Thr Glu
 225 230 235 240

Gly Gly Ala Val Trp Leu Asp Pro Lys Lys Thr Ser Pro Tyr Lys Phe
 245 250 255

Tyr Gln Phe Trp Ile Asn Thr Ala Asp Ala Asp Val Tyr Arg Phe Leu
 260 265 270

Lys Phe Phe Thr Phe Met Ser Ile Glu Glu Ile Asn Ala Leu Glu Glu
 275 280 285

Glu Asp Lys Asn Ser Gly Lys Ala Pro Arg Ala Gln Tyr Val Leu Ala
 290 295 300

Glu Gln Val Thr Arg Leu Val His Gly Glu Glu Gly Leu Gln Ala Ala
 305 310 315 320

Lys Arg Ile Thr Glu Cys Leu Phe Ser Gly Ser Leu Ser Ala Leu Ser
 325 330 335

Glu Ala Asp Phe Glu Gln Leu Ala Gln Asp Gly Val Pro Met Val Glu
 340 345 350

Met Glu Lys Gly Ala Asp Leu Met Gln Ala Leu Val Asp Ser Glu Leu
 355 360 365

Gln Pro Ser Arg Gly Gln Ala Arg Lys Thr Ile Ala Ser Asn Ala Ile
 370 375 380

Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu
 385 390 395 400

Glu Asp Arg Leu Phe Gly Arg Phe Thr Leu Leu Arg Arg Gly Lys Lys
 405 410 415

Asn Tyr Cys Leu Ile Cys Trp Lys
 420

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Ala Gln Val Thr Asp Glu Glu Ala Leu Ala Glu Arg Leu Ala Gln Gly
 20 25 30

Pro Ile Ala Leu Leu Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His
 35 40 45

Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala
 50 55 60

Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly
 65 70 75 80

Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr
 Page 47

85

90

95

Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu
 100 105 110

Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asn Tyr Asp
 115 120 125

Trp Phe Gly Asn Met Asn Val Leu Thr Phe Leu Arg Asp Ile Gly Lys
 130 135 140

His Phe Ser Val Asn Gln Met Ile Asn Lys Glu Ala Val Lys Gln Arg
 145 150 155 160

Leu Asn Arg Glu Asp Gln Gly Ile Ser Phe Thr Glu Phe Ser Tyr Asn
 165 170 175

Leu Leu Gln Gly Tyr Ser Ala Ala Cys Ala Asn Lys Gln Tyr Gly Val
 180 185 190

Val Leu Gln Ile Gly Gly Ser Asp Gln Trp Gly Asn Ile Thr Ser Gly
 195 200 205

Ile Asp Leu Thr Arg Arg Leu His Gln Asn Gln Val Phe Gly Leu Thr
 210 215 220

Val Pro Leu Ile Thr Lys Ala Asp Gly Thr Lys Phe Gly Lys Thr Glu
 225 230 235 240

Gly Gly Ala Val Trp Leu Asp Pro Lys Lys Thr Ser Pro Tyr Lys Phe
 245 250 255

Tyr Gln Phe Trp Ile Asn Thr Ala Asp Ala Asp Val Tyr Arg Phe Leu
 260 265 270

Lys Phe Phe Thr Phe Met Ser Ile Glu Glu Ile Asn Ala Leu Glu Glu
 275 280 285

Glu Asp Lys Asn Ser Gly Lys Ala Pro Arg Ala Gln Tyr Val Leu Ala
 290 295 300

Glu Gln Val Thr Arg Leu Val His Gly Glu Glu Gly Leu Gln Ala Ala
 305 310 315 320

Lys Arg Ile Thr Glu Cys Leu Phe Ser Gly Ser Leu Ser Ala Leu Ser
 325 330 335

Glu Ala Asp Phe Glu Gln Leu Ala Gln Asp Gly Val Pro Met Val Glu
 340 345 350

Met Glu Lys Gly Ala Asp Leu Met Gln Ala Leu Val Asp Ser Glu Leu
 355 360 365

Gln Pro Ser Arg Gly Gln Ala Arg Lys Thr Ile Ala Ser Asn Ala Ile
 370 375 380

Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu
 385 390 395 400

Glu Asp Arg Leu Phe Gly Arg Phe Thr Leu Leu Arg Arg Gly Lys Lys
 405 410 415

Asn Tyr Cys Leu Ile Cys Trp Lys
 420

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Ala Gln Val Thr Asp Glu Glu Ala Leu Ala Glu Arg Leu Ala Gln Gly
 20 25 30

Pro Ile Ala Leu Val Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His
 35 40 45

Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala
 50 55 60

Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly
 65 70 75 80

Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr
 85 90 95

Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu
 100 105 110

Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asn Tyr Asp
 115 120 125

Trp Phe Gly Asn Met Asn Val Leu Thr Phe Leu Arg Asp Ile Gly Lys

130 135 140
 His Phe Ser Val Asn Gln Met Ile Asn Lys Glu Ala Val Lys Gln Arg
 145 150 155 160
 Leu Asn Arg Glu Asp Gln Gly Ile Ser Phe Thr Glu Phe Ser Tyr Asn
 165 170 175
 Leu Leu Gln Gly Tyr Ser Ala Ala Cys Val Asn Lys Gln Tyr Gly Val
 180 185 190
 Val Leu Gln Ile Gly Gly Ser Asp Gln Trp Gly Asn Ile Thr Ser Gly
 195 200 205
 Ile Asp Leu Thr Arg Arg Leu His Gln Asn Gln Val Phe Gly Leu Thr
 210 215 220
 Val Pro Leu Ile Thr Lys Ala Asp Gly Thr Lys Phe Gly Lys Thr Glu
 225 230 235 240
 Gly Gly Ala Val Trp Leu Asp Pro Lys Lys Thr Ser Pro Tyr Lys Phe
 245 250 255
 Tyr Gln Phe Trp Ile Asn Thr Ala Asp Ala Asp Val Tyr Arg Phe Leu
 260 265 270
 Lys Phe Phe Thr Phe Met Ser Ile Glu Glu Ile Asn Ala Leu Glu Glu
 275 280 285
 Glu Asp Lys Asn Ser Gly Lys Ala Pro Arg Ala Gln Tyr Val Leu Ala
 290 295 300
 Glu Gln Val Thr Arg Leu Val His Gly Glu Glu Gly Leu Gln Ala Ala
 305 310 315 320
 Lys Arg Ile Thr Glu Cys Leu Phe Ser Gly Ser Leu Ser Ala Leu Ser
 325 330 335
 Glu Ala Asp Phe Glu Gln Leu Ala Gln Asp Gly Val Pro Met Val Glu
 340 345 350
 Met Glu Lys Gly Ala Asp Leu Met Gln Ala Leu Val Asp Ser Glu Leu
 355 360 365
 Gln Pro Ser Arg Gly Gln Ala Arg Lys Thr Ile Ala Ser Asn Ala Ile
 370 375 380
 Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu
 385 390 395 400

Leu Leu Gln Gly Tyr Asn Phe Ala Cys Val Asn Lys Gln Tyr Gly Val

180

185

190

Val Leu Gln Ile Gly Gly Ser Asp Gln Trp Gly Asn Ile Thr Ser Gly
 195 200 205

Ile Asp Leu Thr Arg Arg Leu His Gln Asn Gln Val Phe Gly Leu Thr
 210 215 220

Val Pro Leu Ile Thr Lys Ala Asp Gly Thr Lys Phe Gly Lys Thr Glu
 225 230 235 240

Gly Gly Ala Val Trp Leu Asp Pro Lys Lys Thr Ser Pro Tyr Lys Phe
 245 250 255

Tyr Gln Phe Trp Ile Asn Thr Ala Asp Ala Asp Val Tyr Arg Phe Leu
 260 265 270

Lys Phe Phe Thr Phe Met Ser Ile Glu Glu Ile Asn Ala Leu Glu Glu
 275 280 285

Glu Asp Lys Asn Ser Gly Lys Ala Pro Arg Ala Gln Tyr Val Leu Ala
 290 295 300

Glu Gln Val Thr Arg Leu Val His Gly Glu Glu Gly Leu Gln Ala Ala
 305 310 315 320

Lys Arg Ile Thr Glu Cys Leu Phe Ser Gly Ser Leu Ser Ala Leu Ser
 325 330 335

Glu Ala Asp Phe Glu Gln Leu Ala Gln Asp Gly Val Pro Met Val Glu
 340 345 350

Met Glu Lys Gly Ala Asp Leu Met Gln Ala Leu Val Asp Ser Glu Leu
 355 360 365

Gln Pro Ser Arg Gly Gln Ala Arg Lys Thr Ile Ala Ser Asn Ala Ile
 370 375 380

Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu
 385 390 395 400

Glu Asp Arg Leu Phe Gly Arg Phe Thr Leu Leu Arg Arg Gly Lys Lys
 405 410 415

Asn Tyr Cys Leu Ile Cys Trp Lys
 420

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Ala Gln Val Thr Asp Glu Glu Ala Leu Ala Glu Arg Leu Ala Gln Gly
 20 25 30

Pro Ile Ala Leu Thr Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His
 35 40 45

Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala
 50 55 60

Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly
 65 70 75 80

Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr
 85 90 95

Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu
 100 105 110

Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asn Tyr Asp
 115 120 125

Trp Phe Gly Asn Met Asn Val Leu Thr Phe Leu Arg Asp Ile Gly Lys
 130 135 140

His Phe Ser Val Asn Gln Met Ile Asn Lys Glu Ala Val Lys Gln Arg
 145 150 155 160

Leu Asn Arg Glu Asp Gln Gly Ile Ser Phe Thr Glu Phe Ser Tyr Asn
 165 170 175

Leu Leu Gln Gly Tyr Ser Ala Ala Cys Leu Asn Lys Gln Tyr Gly Val
 180 185 190

Val Leu Gln Ile Gly Gly Ser Asp Gln Trp Gly Asn Ile Thr Ser Gly
 195 200 205

Ile Asp Leu Thr Arg Arg Leu His Gln Asn Gln Val Phe Gly Leu Thr
 210 215 220

Val Pro Leu Ile Thr Lys Ala Asp Gly Thr Lys Phe Gly Lys Thr Glu
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Met Ala Ser Ser Asn Leu Ile Lys Gln Leu Gln Glu Arg Gly Leu Val
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 20 25 30

Pro Ile Ala Leu Gly Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His
 35 40 45

Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala
 50 55 60

Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly
 65 70 75 80

Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr
 85 90 95

Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu
 100 105 110

Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asn Tyr Asp
 115 120 125

Trp Phe Gly Asn Met Asn Val Leu Thr Phe Leu Arg Asp Ile Gly Lys
 130 135 140

His Phe Ser Val Asn Gln Met Ile Asn Lys Glu Ala Val Lys Gln Arg
 145 150 155 160

Leu Asn Arg Glu Asp Gln Gly Ile Ser Phe Thr Glu Phe Ser Tyr Asn
 165 170 175

Leu Leu Gln Gly Tyr Ser Met Ala Cys Leu Asn Lys Gln Tyr Gly Val
 180 185 190

Val Leu Gln Ile Gly Gly Ser Asp Gln Trp Gly Asn Ile Thr Ser Gly
 195 200 205

Ile Asp Leu Thr Arg Arg Leu His Gln Asn Gln Val Phe Gly Leu Thr
 210 215 220

Val Pro Leu Ile Thr Lys Ala Asp Gly Thr Lys Phe Gly Lys Thr Glu
 225 230 235 240

Gly Gly Ala Val Trp Leu Asp Pro Lys Lys Thr Ser Pro Tyr Lys Phe
 245 250 255

Tyr Gln Phe Trp Ile Asn Thr Ala Asp Ala Asp Val Tyr Arg Phe Leu
 260 265 270

Lys Phe Phe Thr Phe Met Ser Ile Glu Glu Ile Asn Ala Leu Glu Glu

275

280

285

Glu Asp Lys Asn Ser Gly Lys Ala Pro Arg Ala Gln Tyr Val Leu Ala
 290 295 300

Glu Gln Val Thr Arg Leu Val His Gly Glu Glu Gly Leu Gln Ala Ala
 305 310 315 320

Lys Arg Ile Thr Glu Cys Leu Phe Ser Gly Ser Leu Ser Ala Leu Ser
 325 330 335

Glu Ala Asp Phe Glu Gln Leu Ala Gln Asp Gly Val Pro Met Val Glu
 340 345 350

Met Glu Lys Gly Ala Asp Leu Met Gln Ala Leu Val Asp Ser Glu Leu
 355 360 365

Gln Pro Ser Arg Gly Gln Ala Arg Lys Thr Ile Ala Ser Asn Ala Ile
 370 375 380

Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu
 385 390 395 400

Glu Asp Arg Leu Phe Gly Arg Phe Thr Leu Leu Arg Arg Gly Lys Lys
 405 410 415

Asn Tyr Cys Leu Ile Cys Trp Lys
 420

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 20 25 30

Pro Ile Ala Leu Thr Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His
 35 40 45

Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala
 50 55 60

Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly
 65 70 75 80
 Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr
 85 90 95
 Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu
 100 105 110
 Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asn Tyr Asp
 115 120 125
 Trp Phe Gly Asn Met Asn Val Leu Thr Phe Leu Arg Asp Ile Gly Lys
 130 135 140
 His Phe Ser Val Asn Gln Met Ile Asn Lys Glu Ala Val Lys Gln Arg
 145 150 155 160
 Leu Asn Arg Glu Asp Gln Gly Ile Ser Phe Thr Glu Phe Ser Tyr Asn
 165 170 175
 Leu Leu Gln Gly Tyr Ser Ala Ala Cys Leu Asn Lys Gln Tyr Gly Val
 180 185 190
 Val Leu Gln Ile Gly Gly Ser Asp Gln Trp Gly Asn Ile Thr Ser Gly
 195 200 205
 Ile Asp Leu Thr Arg Arg Leu His Gln Asn Gln Val Phe Gly Leu Thr
 210 215 220
 Val Pro Leu Ile Thr Lys Ala Asp Gly Thr Lys Phe Gly Lys Thr Glu
 225 230 235 240
 Gly Gly Ala Val Trp Leu Asp Pro Lys Lys Thr Ser Pro Tyr Lys Phe
 245 250 255
 Tyr Gln Phe Trp Ile Asn Thr Ala Asp Ala Asp Val Tyr Arg Phe Leu
 260 265 270
 Lys Phe Phe Thr Phe Met Ser Ile Glu Glu Ile Asn Ala Leu Glu Glu
 275 280 285
 Glu Asp Lys Asn Ser Gly Lys Ala Pro Arg Ala Gln Tyr Val Leu Ala
 290 295 300
 Glu Gln Val Thr Arg Leu Val His Gly Glu Glu Gly Leu Gln Ala Ala
 305 310 315 320
 Lys Arg Ile Thr Glu Cys Leu Phe Ser Gly Ser Leu Ser Ala Leu Ser

325

330

335

Glu Ala Asp Phe Glu Gln Leu Ala Gln Asp Gly Val Pro Met Val Glu
 340 345 350

Met Glu Lys Gly Ala Asp Leu Met Gln Ala Leu Val Asp Ser Glu Leu
 355 360 365

Gln Pro Ser Arg Gly Gln Ala Arg Lys Thr Ile Ala Ser Asn Ala Ile
 370 375 380

Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu
 385 390 395 400

Glu Asp Arg Leu Phe Gly Arg Phe Thr Leu Leu Arg Arg Gly Lys Lys
 405 410 415

Asn Tyr Cys Leu Ile Cys Trp Lys
 420

<210> 56

<211> 424

<212> PRT

<213> artificial

<220>

<223> artificial synthetase

<400> 56

Met Ala Ser Ser Asn Leu Ile Lys Gln Leu Gln Glu Arg Gly Leu Val
 1 5 10 15

Ala Gln Val Thr Asp Glu Glu Ala Leu Ala Glu Arg Leu Ala Gln Gly
 20 25 30

Pro Ile Ala Leu Ser Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His
 35 40 45

Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala
 50 55 60

Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly
 65 70 75 80

Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr
 85 90 95

Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu
 100 105 110

Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asn Tyr Asp
 115 120 125
 Trp Phe Gly Asn Met Asn Val Leu Thr Phe Leu Arg Asp Ile Gly Lys
 130 135 140
 His Phe Ser Val Asn Gln Met Ile Asn Lys Glu Ala Val Lys Gln Arg
 145 150 155 160
 Leu Asn Arg Glu Asp Gln Gly Ile Ser Phe Thr Glu Phe Ser Tyr Asn
 165 170 175
 Leu Leu Gln Gly Tyr Thr Met Ala Cys Val Asn Lys Gln Tyr Gly Val
 180 185 190
 Val Leu Gln Ile Gly Gly Ser Asp Gln Trp Gly Asn Ile Thr Ser Gly
 195 200 205
 Ile Asp Leu Thr Arg Arg Leu His Gln Asn Gln Val Phe Gly Leu Thr
 210 215 220
 Val Pro Leu Ile Thr Lys Ala Asp Gly Thr Lys Phe Gly Lys Thr Glu
 225 230 235 240
 Gly Gly Ala Val Trp Leu Asp Pro Lys Lys Thr Ser Pro Tyr Lys Phe
 245 250 255
 Tyr Gln Phe Trp Ile Asn Thr Ala Asp Ala Asp Val Tyr Arg Phe Leu
 260 265 270
 Lys Phe Phe Thr Phe Met Ser Ile Glu Glu Ile Asn Ala Leu Glu Glu
 275 280 285
 Glu Asp Lys Asn Ser Gly Lys Ala Pro Arg Ala Gln Tyr Val Leu Ala
 290 295 300
 Glu Gln Val Thr Arg Leu Val His Gly Glu Glu Gly Leu Gln Ala Ala
 305 310 315 320
 Lys Arg Ile Thr Glu Cys Leu Phe Ser Gly Ser Leu Ser Ala Leu Ser
 325 330 335
 Glu Ala Asp Phe Glu Gln Leu Ala Gln Asp Gly Val Pro Met Val Glu
 340 345 350
 Met Glu Lys Gly Ala Asp Leu Met Gln Ala Leu Val Asp Ser Glu Leu
 355 360 365
 Gln Pro Ser Arg Gly Gln Ala Arg Lys Thr Ile Ala Ser Asn Ala Ile

370

375

380

Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu
 385 390 395 400

Glu Asp Arg Leu Phe Gly Arg Phe Thr Leu Leu Arg Arg Gly Lys Lys
 405 410 415

Asn Tyr Cys Leu Ile Cys Trp Lys
 420

<210> 57

<211> 424

<212> PRT

<213> artificial

<220>

<223> artificial synthetase

<400> 57

Met Ala Ser Ser Asn Leu Ile Lys Gln Leu Gln Glu Arg Gly Leu Val
 1 5 10 15

Ala Gln Val Thr Asp Glu Glu Ala Leu Ala Glu Arg Leu Ala Gln Gly
 20 25 30

Pro Ile Ala Leu Ala Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His
 35 40 45

Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala
 50 55 60

Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly
 65 70 75 80

Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr
 85 90 95

Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu
 100 105 110

Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asn Tyr Asp
 115 120 125

Trp Phe Gly Asn Met Asn Val Leu Thr Phe Leu Arg Asp Ile Gly Lys
 130 135 140

His Phe Ser Val Asn Gln Met Ile Asn Lys Glu Ala Val Lys Gln Arg
 145 150 155 160

Page 61

420

<210> 58
 <211> 424
 <212> PRT
 <213> artificial

<220>
 <223> artificial synthetase

<400> 58

Met Ala Ser Ser Asn Leu Ile Lys Gln Leu Gln Glu Arg Gly Leu Val
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Ala Gln Val Thr Asp Glu Glu Ala Leu Ala Glu Arg Leu Ala Gln Gly
 20 25 30

Pro Ile Ala Leu Ala Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His
 35 40 45

Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala
 50 55 60

Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly
 65 70 75 80

Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr
 85 90 95

Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu
 100 105 110

Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asn Tyr Asp
 115 120 125

Trp Phe Gly Asn Met Asn Val Leu Thr Phe Leu Arg Asp Ile Gly Lys
 130 135 140

His Phe Ser Val Asn Gln Met Ile Asn Lys Glu Ala Val Lys Gln Arg
 145 150 155 160

Leu Asn Arg Glu Asp Gln Gly Ile Ser Phe Thr Glu Phe Ser Tyr Asn
 165 170 175

Leu Leu Gln Gly Tyr Thr Met Ala Cys Cys Asn Lys Gln Tyr Gly Val
 180 185 190

Val Leu Gln Ile Gly Gly Ser Asp Gln Trp Gly Asn Ile Thr Ser Gly
 195 200 205

Ile Asp Leu Thr Arg Arg Leu His Gln Asn Gln Val Phe Gly Leu Thr
 210 215 220
 Val Pro Leu Ile Thr Lys Ala Asp Gly Thr Lys Phe Gly Lys Thr Glu
 225 230 235 240
 Gly Gly Ala Val Trp Leu Asp Pro Lys Lys Thr Ser Pro Tyr Lys Phe
 245 250 255
 Tyr Gln Phe Trp Ile Asn Thr Ala Asp Ala Asp Val Tyr Arg Phe Leu
 260 265 270
 Lys Phe Phe Thr Phe Met Ser Ile Glu Glu Ile Asn Ala Leu Glu Glu
 275 280 285
 Glu Asp Lys Asn Ser Gly Lys Ala Pro Arg Ala Gln Tyr Val Leu Ala
 290 295 300
 Glu Gln Val Thr Arg Leu Val His Gly Glu Glu Gly Leu Gln Ala Ala
 305 310 315 320
 Lys Arg Ile Thr Glu Cys Leu Phe Ser Gly Ser Leu Ser Ala Leu Ser
 325 330 335
 Glu Ala Asp Phe Glu Gln Leu Ala Gln Asp Gly Val Pro Met Val Glu
 340 345 350
 Met Glu Lys Gly Ala Asp Leu Met Gln Ala Leu Val Asp Ser Glu Leu
 355 360 365
 Gln Pro Ser Arg Gly Gln Ala Arg Lys Thr Ile Ala Ser Asn Ala Ile
 370 375 380
 Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu
 385 390 395 400
 Glu Asp Arg Leu Phe Gly Arg Phe Thr Leu Leu Arg Arg Gly Lys Lys
 405 410 415
 Asn Tyr Cys Leu Ile Cys Trp Lys
 420

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<220>
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<400> 59

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 20 25 30
 Pro Ile Ala Leu Thr Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His
 35 40 45
 Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala
 50 55 60
 Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly
 65 70 75 80
 Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr
 85 90 95
 Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu
 100 105 110
 Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asn Tyr Asp
 115 120 125
 Trp Phe Gly Asn Met Asn Val Leu Thr Phe Leu Arg Asp Ile Gly Lys
 130 135 140
 His Phe Ser Val Asn Gln Met Ile Asn Lys Glu Ala Val Lys Gln Arg
 145 150 155 160
 Leu Asn Arg Glu Asp Gln Gly Ile Ser Phe Thr Glu Phe Ser Tyr Asn
 165 170 175
 Leu Leu Gln Gly Tyr Thr Phe Ala Cys Met Asn Lys Gln Tyr Gly Val
 180 185 190
 Val Leu Gln Ile Gly Gly Ser Asp Gln Trp Gly Asn Ile Thr Ser Gly
 195 200 205
 Ile Asp Leu Thr Arg Arg Leu His Gln Asn Gln Val Phe Gly Leu Thr
 210 215 220
 Val Pro Leu Ile Thr Lys Ala Asp Gly Thr Lys Phe Gly Lys Thr Glu
 225 230 235 240
 Gly Gly Ala Val Trp Leu Asp Pro Lys Lys Thr Ser Pro Tyr Lys Phe
 245 250 255

Tyr Gln Phe Trp Ile Asn Thr Ala Asp Ala Asp Val Tyr Arg Phe Leu
 260 265 270

Lys Phe Phe Thr Phe Met Ser Ile Glu Glu Ile Asn Ala Leu Glu Glu
 275 280 285

Glu Asp Lys Asn Ser Gly Lys Ala Pro Arg Ala Gln Tyr Val Leu Ala
 290 295 300

Glu Gln Val Thr Arg Leu Val His Gly Glu Glu Gly Leu Gln Ala Ala
 305 310 315 320

Lys Arg Ile Thr Glu Cys Leu Phe Ser Gly Ser Leu Ser Ala Leu Ser
 325 330 335

Glu Ala Asp Phe Glu Gln Leu Ala Gln Asp Gly Val Pro Met Val Glu
 340 345 350

Met Glu Lys Gly Ala Asp Leu Met Gln Ala Leu Val Asp Ser Glu Leu
 355 360 365

Gln Pro Ser Arg Gly Gln Ala Arg Lys Thr Ile Ala Ser Asn Ala Ile
 370 375 380

Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu
 385 390 395 400

Glu Asp Arg Leu Phe Gly Arg Phe Thr Leu Leu Arg Arg Gly Lys Lys
 405 410 415

Asn Tyr Cys Leu Ile Cys Trp Lys
 420

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<400> 60

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Ala Gln Val Thr Asp Glu Glu Ala Leu Ala Glu Arg Leu Ala Gln Gly
 20 25 30

Pro Ile Ala Leu Thr Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His
 35 40 45

Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala
 50 55 60
 Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly
 65 70 75 80
 Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr
 85 90 95
 Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu
 100 105 110
 Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asn Tyr Asp
 115 120 125
 Trp Phe Gly Asn Met Asn Val Leu Thr Phe Leu Arg Asp Ile Gly Lys
 130 135 140
 His Phe Ser Val Asn Gln Met Ile Asn Lys Glu Ala Val Lys Gln Arg
 145 150 155 160
 Leu Asn Arg Glu Asp Gln Gly Ile Ser Phe Thr Glu Phe Ser Tyr Asn
 165 170 175
 Leu Leu Gln Gly Tyr Ser Val Ala Cys Leu Asn Lys Gln Tyr Gly Val
 180 185 190
 Val Leu Gln Ile Gly Gly Ser Asp Gln Trp Gly Asn Ile Thr Ser Gly
 195 200 205
 Ile Asp Leu Thr Arg Arg Leu His Gln Asn Gln Val Phe Gly Leu Thr
 210 215 220
 Val Pro Leu Ile Thr Lys Ala Asp Gly Thr Lys Phe Gly Lys Thr Glu
 225 230 235 240
 Gly Gly Ala Val Trp Leu Asp Pro Lys Lys Thr Ser Pro Tyr Lys Phe
 245 250 255
 Tyr Gln Phe Trp Ile Asn Thr Ala Asp Ala Asp Val Tyr Arg Phe Leu
 260 265 270
 Lys Phe Phe Thr Phe Met Ser Ile Glu Glu Ile Asn Ala Leu Glu Glu
 275 280 285
 Glu Asp Lys Asn Ser Gly Lys Ala Pro Arg Ala Gln Tyr Val Leu Ala
 290 295 300

Glu Gln Val Thr Arg Leu Val His Gly Glu Glu Gly Leu Gln Ala Ala
 305 310 315 320

Lys Arg Ile Thr Glu Cys Leu Phe Ser Gly Ser Leu Ser Ala Leu Ser
 325 330 335

Glu Ala Asp Phe Glu Gln Leu Ala Gln Asp Gly Val Pro Met Val Glu
 340 345 350

Met Glu Lys Gly Ala Asp Leu Met Gln Ala Leu Val Asp Ser Glu Leu
 355 360 365

Gln Pro Ser Arg Gly Gln Ala Arg Lys Thr Ile Ala Ser Asn Ala Ile
 370 375 380

Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu
 385 390 395 400

Glu Asp Arg Leu Phe Gly Arg Phe Thr Leu Leu Arg Arg Gly Lys Lys
 405 410 415

Asn Tyr Cys Leu Ile Cys Trp Lys
 420

<210> 61
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<220>
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<400> 61

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 20 25 30

Pro Ile Ala Leu Val Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His
 35 40 45

Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala
 50 55 60

Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly
 65 70 75 80

Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr
 85 90 95

Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu
 100 105 110
 Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asn Tyr Asp
 115 120 125
 Trp Phe Gly Asn Met Asn Val Leu Thr Phe Leu Arg Asp Ile Gly Lys
 130 135 140
 His Phe Ser Val Asn Gln Met Ile Asn Lys Glu Ala Val Lys Gln Arg
 145 150 155 160
 Leu Asn Arg Glu Asp Gln Gly Ile Ser Phe Thr Glu Phe Ser Tyr Asn
 165 170 175
 Leu Leu Gln Gly Tyr Ser Met Ala Cys Thr Asn Lys Gln Tyr Gly Val
 180 185 190
 Val Leu Gln Ile Gly Gly Ser Asp Gln Trp Gly Asn Ile Thr Ser Gly
 195 200 205
 Ile Asp Leu Thr Arg Arg Leu His Gln Asn Gln Val Phe Gly Leu Thr
 210 215 220
 Val Pro Leu Ile Thr Lys Ala Asp Gly Thr Lys Phe Gly Lys Thr Glu
 225 230 235 240
 Gly Gly Ala Val Trp Leu Asp Pro Lys Lys Thr Ser Pro Tyr Lys Phe
 245 250 255
 Tyr Gln Phe Trp Ile Asn Thr Ala Asp Ala Asp Val Tyr Arg Phe Leu
 260 265 270
 Lys Phe Phe Thr Phe Met Ser Ile Glu Glu Ile Asn Ala Leu Glu Glu
 275 280 285
 Glu Asp Lys Asn Ser Gly Lys Ala Pro Arg Ala Gln Tyr Val Leu Ala
 290 295 300
 Glu Gln Val Thr Arg Leu Val His Gly Glu Glu Gly Leu Gln Ala Ala
 305 310 315 320
 Lys Arg Ile Thr Glu Cys Leu Phe Ser Gly Ser Leu Ser Ala Leu Ser
 325 330 335
 Glu Ala Asp Phe Glu Gln Leu Ala Gln Asp Gly Val Pro Met Val Glu
 340 345 350

Met Glu Lys Gly Ala Asp Leu Met Gln Ala Leu Val Asp Ser Glu Leu
 355 360 365

Gln Pro Ser Arg Gly Gln Ala Arg Lys Thr Ile Ala Ser Asn Ala Ile
 370 375 380

Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu
 385 390 395 400

Glu Asp Arg Leu Phe Gly Arg Phe Thr Leu Leu Arg Arg Gly Lys Lys
 405 410 415

Asn Tyr Cys Leu Ile Cys Trp Lys
 420

<210> 62
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 <213> artificial

<220>
 <223> artificial synthetase

<400> 62

Met Ala Ser Ser Asn Leu Ile Lys Gln Leu Gln Glu Arg Gly Leu Val
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Ala Gln Val Thr Asp Glu Glu Ala Leu Ala Glu Arg Leu Ala Gln Gly
 20 25 30

Pro Ile Ala Leu Ser Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His
 35 40 45

Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala
 50 55 60

Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly
 65 70 75 80

Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr
 85 90 95

Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu
 100 105 110

Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asn Tyr Asp
 115 120 125

Trp Phe Gly Asn Met Asn Val Leu Thr Phe Leu Arg Asp Ile Gly Lys
 130 135 140

His Phe Ser Val Asn Gln Met Ile Asn Lys Glu Ala Val Lys Gln Arg
 145 150 155 160
 Leu Asn Arg Glu Asp Gln Gly Ile Ser Phe Thr Glu Phe Ser Tyr Asn
 165 170 175
 Leu Leu Gln Gly Tyr Ser Phe Ala Cys Leu Asn Lys Gln Tyr Gly Val
 180 185 190
 Val Leu Gln Ile Gly Gly Ser Asp Gln Trp Gly Asn Ile Thr Ser Gly
 195 200 205
 Ile Asp Leu Thr Arg Arg Leu His Gln Asn Gln Val Phe Gly Leu Thr
 210 215 220
 Val Pro Leu Ile Thr Lys Ala Asp Gly Thr Lys Phe Gly Lys Thr Glu
 225 230 235 240
 Gly Gly Ala Val Trp Leu Asp Pro Lys Lys Thr Ser Pro Tyr Lys Phe
 245 250 255
 Tyr Gln Phe Trp Ile Asn Thr Ala Asp Ala Asp Val Tyr Arg Phe Leu
 260 265 270
 Lys Phe Phe Thr Phe Met Ser Ile Glu Glu Ile Asn Ala Leu Glu Glu
 275 280 285
 Glu Asp Lys Asn Ser Gly Lys Ala Pro Arg Ala Gln Tyr Val Leu Ala
 290 295 300
 Glu Gln Val Thr Arg Leu Val His Gly Glu Glu Gly Leu Gln Ala Ala
 305 310 315 320
 Lys Arg Ile Thr Glu Cys Leu Phe Ser Gly Ser Leu Ser Ala Leu Ser
 325 330 335
 Glu Ala Asp Phe Glu Gln Leu Ala Gln Asp Gly Val Pro Met Val Glu
 340 345 350
 Met Glu Lys Gly Ala Asp Leu Met Gln Ala Leu Val Asp Ser Glu Leu
 355 360 365
 Gln Pro Ser Arg Gly Gln Ala Arg Lys Thr Ile Ala Ser Asn Ala Ile
 370 375 380
 Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu
 385 390 395 400

Glu Asp Arg Leu Phe Gly Arg Phe Thr Leu Leu Arg Arg Gly Lys Lys
 405 410 415

Asn Tyr Cys Leu Ile Cys Trp Lys
 420

<210> 63
 <211> 424
 <212> PRT
 <213> artificial

<220>
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<400> 63

Met Ala Ser Ser Asn Leu Ile Lys Gln Leu Gln Glu Arg Gly Leu Val
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Ala Gln Val Thr Asp Glu Glu Ala Leu Ala Glu Arg Leu Ala Gln Gly
 20 25 30

Pro Ile Ala Leu Thr Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His
 35 40 45

Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala
 50 55 60

Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly
 65 70 75 80

Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr
 85 90 95

Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu
 100 105 110

Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asn Tyr Asp
 115 120 125

Trp Phe Gly Asn Met Asn Val Leu Thr Phe Leu Arg Asp Ile Gly Lys
 130 135 140

His Phe Ser Val Asn Gln Met Ile Asn Lys Glu Ala Val Lys Gln Arg
 145 150 155 160

Leu Asn Arg Glu Asp Gln Gly Ile Ser Phe Thr Glu Phe Ser Tyr Asn
 165 170 175

Leu Leu Gln Gly Tyr Thr Phe Ala Cys Thr Asn Lys Gln Tyr Gly Val
 180 185 190

Val Leu Gln Ile Gly Gly Ser Asp Gln Trp Gly Asn Ile Thr Ser Gly
 195 200 205
 Ile Asp Leu Thr Arg Arg Leu His Gln Asn Gln Val Phe Gly Leu Thr
 210 215 220
 Val Pro Leu Ile Thr Lys Ala Asp Gly Thr Lys Phe Gly Lys Thr Glu
 225 230 235 240
 Gly Gly Ala Val Trp Leu Asp Pro Lys Lys Thr Ser Pro Tyr Lys Phe
 245 250 255
 Tyr Gln Phe Trp Ile Asn Thr Ala Asp Ala Asp Val Tyr Arg Phe Leu
 260 265 270
 Lys Phe Phe Thr Phe Met Ser Ile Glu Glu Ile Asn Ala Leu Glu Glu
 275 280 285
 Glu Asp Lys Asn Ser Gly Lys Ala Pro Arg Ala Gln Tyr Val Leu Ala
 290 295 300
 Glu Gln Val Thr Arg Leu Val His Gly Glu Glu Gly Leu Gln Ala Ala
 305 310 315 320
 Lys Arg Ile Thr Glu Cys Leu Phe Ser Gly Ser Leu Ser Ala Leu Ser
 325 330 335
 Glu Ala Asp Phe Glu Gln Leu Ala Gln Asp Gly Val Pro Met Val Glu
 340 345 350
 Met Glu Lys Gly Ala Asp Leu Met Gln Ala Leu Val Asp Ser Glu Leu
 355 360 365
 Gln Pro Ser Arg Gly Gln Ala Arg Lys Thr Ile Ala Ser Asn Ala Ile
 370 375 380
 Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu
 385 390 395 400
 Glu Asp Arg Leu Phe Gly Arg Phe Thr Leu Leu Arg Arg Gly Lys Lys
 405 410 415
 Asn Tyr Cys Leu Ile Cys Trp Lys
 420

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 <211> 129
 <212> DNA
 <213> Escherichia coli

<400> 64
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 ggccaaaggg agcagactct aaatctgccg tcatcgacct cgaagggttcg aatccttccc 120
 ccaccacca 129

<210> 65
 <211> 129
 <212> RNA
 <213> Escherichia coli

<400> 65
 agcuucccga uaagggagca ggccaguaaa aagcauuacc ccgugguggg guucccgagc 60
 ggccaaaggg agcagacucu aaaucugccg ucaucgaccu cgaagguucg aauccuuccc 120
 ccaccacca 129

<210> 66
 <211> 34
 <212> DNA
 <213> artificial

<220>
 <223> oligonucleotide primer

<400> 66
 atgaagtagc tgtcttctat cgaacaagca tgcg 34

<210> 67
 <211> 34
 <212> DNA
 <213> artificial

<220>
 <223> oligonucleotide primer

<400> 67
 cgaacaagca tgcgattagt gccgacttaa aaag 34

<210> 68
 <211> 33
 <212> DNA
 <213> artificial

<220>
 <223> oligonucleotide primer

<400> 68
 cgctactctc ccaaatagaa aaggtctccg ctg 33

<210> 69
 <211> 32
 <212> DNA
 <213> artificial

<220>
 <223> oligonucleotide primer

<400> 69
ctggaacagc tatagctact gatttttcct cg 32

<210> 70
<211> 34
<212> DNA
<213> artificial

<220>
<223> oligonucleotide primer

<400> 70
gccgtcacag attagttggc ttcagtggag actg 34

<210> 71
<211> 33
<212> DNA
<213> artificial

<220>
<223> oligonucleotide primer

<400> 71
gattggcttc ataggagact gatatgctct aac 33

<210> 72
<211> 33
<212> DNA
<213> artificial

<220>
<223> oligonucleotide primer

<400> 72
gcctctatag ttgagacagc atagaataat gcg 33

<210> 73
<211> 35
<212> DNA
<213> artificial

<220>
<223> oligonucleotide primer

<400> 73
gagacagcat agatagagtg cgacatcatc atcgg 35

<210> 74
<211> 37
<212> DNA
<213> artificial

<220>
<223> oligonucleotide primer

<400> 74
gaataagtgc gacatagtca tcggaagaga gtagtag 37

<210> 75
<211> 35
<212> DNA
<213> artificial

<220>
<223> oligonucleotide primer

<400> 75
ggtcaaagac agttgtaggt atcgattgac tcggc

35

<210> 76
<211> 34
<212> DNA
<213> artificial

<220>
<223> oligonucleotide primer

<400> 76
cgctactctc cccaaattta aaaggtctcc gctg

34

<210> 77
<211> 34
<212> DNA
<213> artificial

<220>
<223> oligonucleotide primer

<400> 77
cgctactctc cccaaatata aaaggtctcc gctg

34

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<211> 34
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<220>
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<400> 78
cgctactctc cccaaatgga aaaggtctcc gctg

34

<210> 79
<211> 34
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<220>
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34

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<220>
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<400> 80
cgctactctc cccaaaaaaa aaaggtctcc gctg 34

<210> 81
<211> 34
<212> DNA
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<220>
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<400> 81
gccgtcacag attttttggc ttcagtggag actg 34

<210> 82
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<212> DNA
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<220>
<223> oligonucleotide primer

<400> 82
gccgtcacag attatttggc ttcagtggag actg 34

<210> 83
<211> 34
<212> DNA
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<220>
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<400> 83
gccgtcacag attggttggc ttcagtggag actg 34

<210> 84
<211> 34
<212> DNA
<213> artificial

<220>
<223> oligonucleotide primer

<400> 84
gccgtcacag atgatttggc ttcagtggag actg 34

<210> 85
<211> 34
<212> DNA
<213> artificial

<220>
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<400> 85
gccgtcacag ataaattggc ttcagtggag actg 34

<210> 86
 <211> 424
 <212> PRT
 <213> artificial

<220>
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<400> 86

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 20 25 30

Pro Ile Ala Leu Ile Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His
 35 40 45

Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala
 50 55 60

Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly
 65 70 75 80

Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr
 85 90 95

Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu
 100 105 110

Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asn Tyr Asp
 115 120 125

Trp Phe Gly Asn Met Asn Val Leu Thr Phe Leu Arg Asp Ile Gly Lys
 130 135 140

His Phe Ser Val Asn Gln Met Ile Asn Lys Glu Ala Val Lys Gln Arg
 145 150 155 160

Leu Asn Arg Glu Gly Gln Gly Ile Ser Phe Thr Glu Phe Ser Tyr Asn
 165 170 175

Leu Leu Gln Gly Tyr Gly Met Ala Cys Ala Asn Lys Gln Tyr Gly Val
 180 185 190

Val Leu Gln Ile Gly Gly Ser Asp Gln Trp Gly Asn Ile Thr Ser Gly
 195 200 205

Ile Asp Leu Thr Arg Arg Leu His Gln Asn Gln Val Phe Gly Leu Thr

210

215

220

Val Pro Leu Ile Thr Lys Ala Asp Gly Thr Lys Phe Gly Lys Thr Glu
 225 230 235 240

Gly Gly Ala Val Trp Leu Asp Pro Lys Lys Thr Ser Pro Tyr Lys Phe
 245 250 255

Tyr Gln Phe Trp Ile Asn Thr Ala Asp Ala Asp Val Tyr Arg Phe Leu
 260 265 270

Lys Phe Phe Thr Phe Met Ser Ile Glu Glu Ile Asn Ala Leu Glu Glu
 275 280 285

Glu Asp Lys Asn Ser Gly Lys Ala Pro Arg Ala Gln Tyr Val Leu Ala
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Glu Gln Val Thr Arg Leu Val His Gly Glu Glu Gly Leu Gln Ala Ala
 305 310 315 320

Lys Arg Ile Thr Glu Cys Leu Phe Ser Gly Ser Leu Ser Ala Leu Ser
 325 330 335

Glu Ala Asp Phe Glu Gln Leu Ala Gln Asp Gly Val Pro Met Val Glu
 340 345 350

Met Glu Lys Gly Ala Asp Leu Met Gln Ala Leu Val Asp Ser Glu Leu
 355 360 365

Gln Pro Ser Arg Gly Gln Ala Arg Lys Thr Ile Ala Ser Asn Ala Ile
 370 375 380

Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu
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Glu Asp Arg Leu Phe Gly Arg Phe Thr Leu Leu Arg Arg Gly Lys Lys
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Asn Tyr Cys Leu Ile Cys Trp Lys
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<220>

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<220>

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 p-benzoyl-L-phenylalanine, p-azido-L-phenylalanine,
 O-methyl-L-tyrosine, or p-iodo-L-phenylalanine) or tryptophan,
 tyrosine, or leucine

 <400> 87
 Val Xaa Gly Ser Ile Lys
 1 5

 <210> 88
 <211> 11
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 <220>
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 <220>
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 ttaccccgtg gtgggttccc ga 82

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 ttttgaaaaa aatggtggtg ggggaaggat 90

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